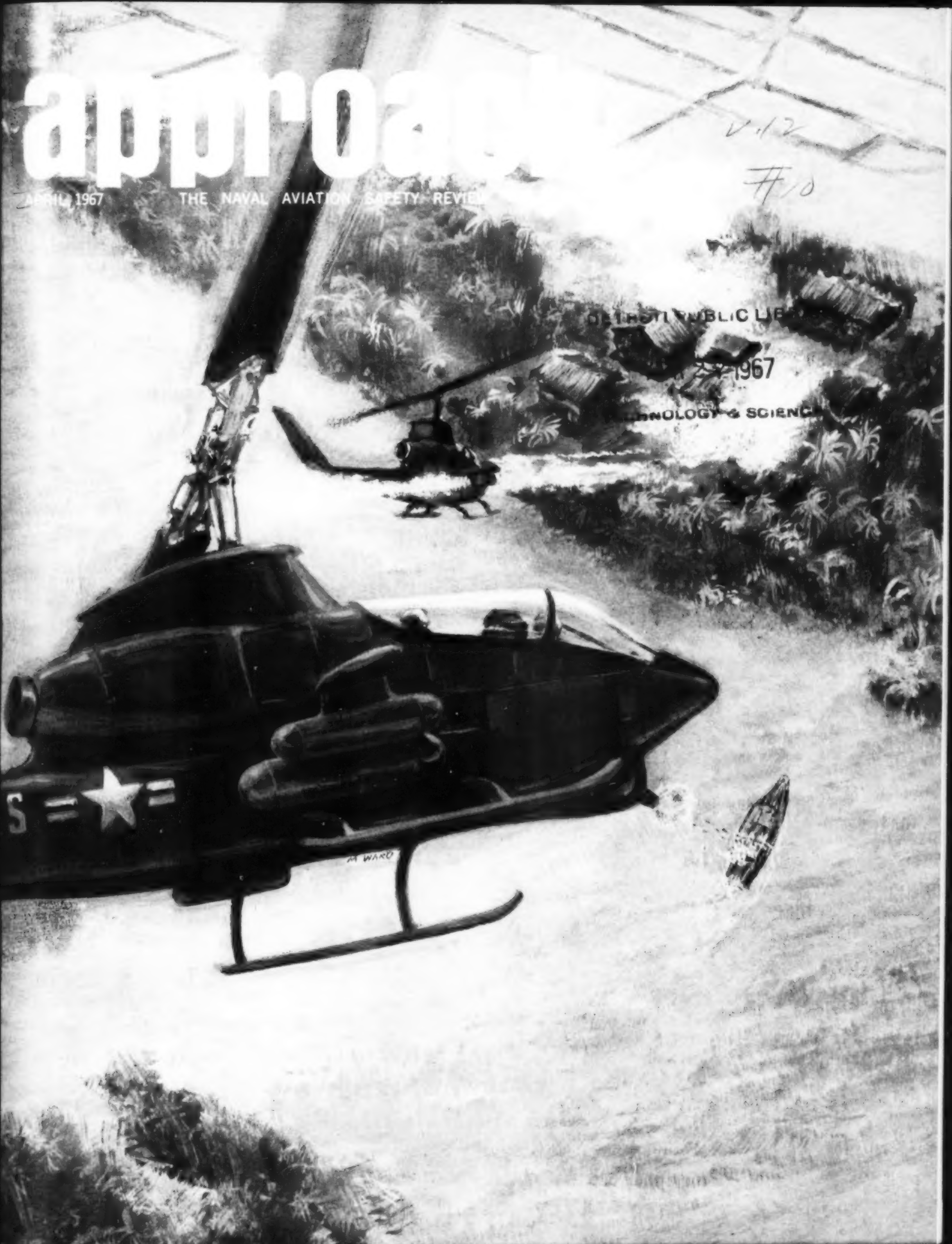
approach

APRIL 1967 THE NAVAL AVIATION SAFETY REVIEW



My Skyhawk took a hit over the target. . . The fire warning light came on but I elected to stay with it until passing the beach line.

SURVIVAL— the hard way

When his Skyhawk was hit by enemy ground fire during a bombing run on a bridge, this pilot managed to clear the coastline before he tried to eject. Neither face curtain nor alternate firing handle worked although the canopy was jettisoned. After pulling the ditching handle, he was finally thrown clear of the spinning aircraft. He manually actuated his parachute and made a successful water entry but his troubles were far from over. Now he faced shroud line entanglement and small arms fire from shore. Again he was successful in coping with the situation. An experienced swimmer, he inflated his life preserver, discarded his raft pack and headed for sea. One hour later he was rescued.

I was assigned to lead a section of A-4C *Skyhawks* for a dual role of flak suppression and bombing of a bridge on Highway One in North Vietnam. The Air Wing Commander, acting as target coordinator, having determined that the flak had been sufficiently suppressed, cleared my flight to bomb the target. A few seconds later, I rolled into a high dive-bombing run on the bridge.

After releasing my bombs I commenced my pull-out during which I felt a sharp thud on the underside of the aircraft. I assumed immediately that I had been hit by enemy ground fire. Almost simultaneously I heard several transmissions telling me that my aircraft was on fire and to eject.

I took a quick glance at my engine instruments and noticed that the fire warning light was ON. However, I was at that time still over land and elected to stay with the aircraft until I was far enough over water to enable a rescue aircraft to effect a safe pick up. I then felt a decrease in thrust from the engine. Deciding that I had pushed my luck far enough with the engine and ascertaining that I had reached sufficient altitude to clear the coast line by a safe margin in a powerless glide, I secured the engine.

Shortly after I brought the throttle around the horn to the cut-off position, both of my rudder pedals felt like they had been disconnected and went to their forward stops simultaneously. My first reaction was that the fire had burned through the rudder control cables. However, I later found out that the entire tail section had separated from the aircraft. Since the A-4 was not designed to be a flying wing, it immediately made a violent downward pitch and entered a flat spin. At this time I attempted to eject.

I reached for the face curtain and pulled it out and down over my face. The canopy separated from the aircraft as advertised but the ejection seat did not fire. After giving the face curtain another hard jerk, I reached for the alternate firing handle between my legs and gave it sharp jerk upward, also with no success. I then reached down on the right side of the seat and grabbed the harness release (ditching) handle and gave it a sharp pull upward. On doing this, I was released from the ejection seat along with my parachute and was thrown about two-thirds clear of the cockpit.

Due to the flat spin and the forward force acting on my body, I became trapped in that position with

my lower legs wedged back against the seat and my thighs against the forward wind screen canopy bow. I attempted to get my arms down out of the wind blast to push myself clear but could not because of the wind and gyrations of the aircraft. I knew then that I was helpless and could only think about my wife and children back home and pray to God that He take care of them and help them to understand. Shortly thereafter I was thrown clear of the aircraft at what I estimate to be around 2500 ft.

I knew that I was close to the beach and well within range of enemy small arms fire which I personally felt had resulted in the deaths of two other pilots who went in right off the beach in recent strikes. Consequently, I let myself free fall to what I thought was about 1000 ft before I pulled my D-ring and deployed my chute. Later I found out that I had misjudged my altitude and was closer to 400 or 500 ft when my chute blossomed. In any event, there was very little time for the enemy to get off any shots at me while I was descending in the chute.

I landed in the water about a quarter mile off shore and released myself from the risers by detaching the rocket jet fittings. Immediately I became entangled in the parachute shroud lines which had sunk just below the surface of the water. I then inflated my Mk-3C life preserver, removed my gloves and took out my shroud cutter which was encased in the open position in a sheath on the front of my survival vest. I commenced cutting the shroud line entanglement away from my torso harness and my legs with one hand while swimming seaward with the other.

Swimming away from the chute enabled me to quickly determine the shroud lines to which I was still entangled by the tension being applied to various parts of my legs and harness. Once I was cleared of the entanglement, I released my survival kit and pararaft. I had determined that I would make too good a target for small arms if I used my raft and it would also greatly reduce my SOA through the water if I attempted to carry it uninflated.

Initially after entering the water and removing my flight gloves, I discovered a rather deep laceration on my left thumb which I apparently had received on exiting the cockpit. It was bleeding quite heavily and my first thought was to get it stopped and lessen the chance of any shark action. However, the shark situation became rather secondary when I heard the bullets hitting and ricocheting off the water around

me so I forgot about trying to stop the bleeding. From time to time I checked it and found that the bleeding hadn't lessened any but I still concluded that the sharks were less of a threat than the bullets and soon forgot about it.

At this time, being well aware of the rescap aircraft overhead, I drew my .38 pistol from my shoulder holster and fired three tracers into the air to let them know I was still alive. This I found later was very ineffective as none of the pilots saw any tracers coming from anywhere other than enemy ground fire on the beach. Shortly thereafter, my wingman made a low pass over me and seeing him return my arm-waving made me considerably more at ease.

I then noticed my dye marker leaking from its container. Leaving a bright green trail behind me I commenced swimming out to sea. The dye marker proved to be a great aid for the rescap pilots in keeping me in sight. I began a steady conventional breast stroke out to sea at the moderate pace which, I knew from experience on both high school swimming and college water polo teams, I could keep up for an indefinite period of time.

At first I wasn't sure that I was making much headway as the wind and tide were tending to drift me in closer to the shore but I soon observed an outcropping of rocks on the next cove which was getting steadily bigger and bigger. This gave me assurance of my progress. During the hour I was in the water, prior to the arrival of the HU-16, I managed to get myself another half to three-quarters of a mile out to sea. With only my helmet and the back portion of my Mk-3C showing above water I provided a very small target from the beach. As I swam seaward, the bullets which were hitting and occasionally ricocheting off the water around me seemed to be decreasing in both frequency and accuracy. This, needless to say, was quite reassuring.

The rescap aircraft seemed to be drawing varied amounts of small arms and automatic weapons fire in proportion to their proximity to the beach.

At one time I considered removing my combat boots to make swimming a little easier, but I also thought of the possibility of capture and I wasn't real wild about the idea of walking all over North Vietnam without any footgear so I decided to do the best I could with them on.

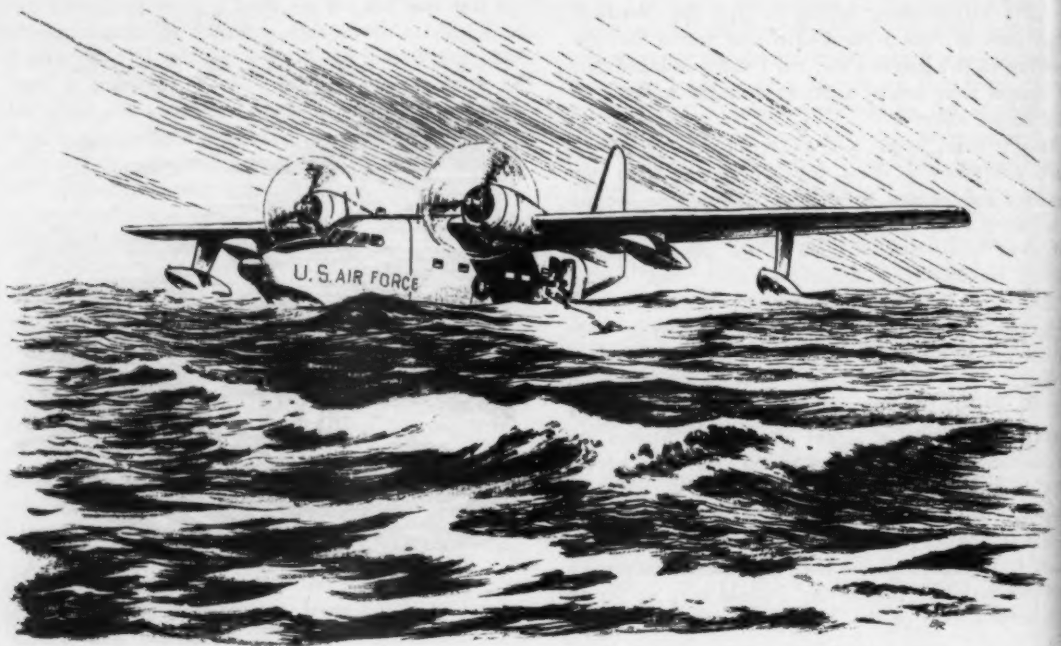
About 10 to 15 minutes after I had landed in the water, I saw and heard one of the rescap aircraft making a firing run on something about one-half mile from my position seaward. A short time after that I spotted an outrigger canoe floating in the water in

that same general direction. From where I was the canoe appeared to be empty so I started swimming for it with the thought in mind to approach it with weapon in hand and assume command of it. I found out later that I would probably have had to use my gun on boarding it because the occupants played dead in the bottom of the dugout after the first warning shots were fired across its bow.

I never had much doubt that the HU-16 aircraft would be on the scene within a short time and that I could be rescued by him if it were at all possible. I had all the confidence in the world in their ability after seeing them pick my section leader out of the water two months before. However, I did know that the conditions were much more favorable in his case since he was about five miles out to sea and the sea state was extremely calm.

Approximately 45 minutes after I hit the water, I spotted two HU-16s coming into the area and welcomed them with a sigh of relief and a prayer of thanks. They circled the area for about 10 minutes trying to determine whether or not the sea state was within limits for their aircraft. When I determined that they had my general position I lit off a day-smoke signal which was, I found later, extremely useful to them in determining both my position and the direction of wind.

When they came closer to my position the second time around, I attempted to light off the night flare but the firing wire broke due to its age (the wire was



quite rusty). I then broke out the other flare I had in my Mk-3C. I waited until just before the HU-16 landed to light off this second day signal.

The daysmoke signal initially gave the HU-16 a good fix on my position and they knew the general direction in which to taxi after they touched down about a half mile out to sea from me. When they got within about one quarter of a mile from me I lit off the night flare end of the signal and held it as high as I could. This gave them another accurate fix on my position. The copilot of the HU-16 later told me that he only saw the night flare once between swells in the water but it was enough to accurately determine the direction to taxi.

After pulling in close, they motioned for me to swim to the port side of the aircraft and to stay clear of the propellers. Normally in a calm sea state there is 4½ ft of clearance between the props and the water. However I had noticed the bottoms of the props dipping into the water several times while he was taxiing to my position so I did stay well clear of them. Once around the props, I saw the crew members motioning hastily for me to come on and reaching out to me with a small boat hook.

When I grabbed the boat hook, they pulled me into the hatch as far as they could and then grasped the bottom of my torso harness and lifted me into the aircraft in a rather expeditious manner. The hatch was quickly secured and the first series of takeoffs was attempted. After about three or four unsuccessful attempts to take off, they throttled the engines back and commenced taxiing farther out to sea. I was told later that during these first takeoff attempts the cylinder head temperature and oil pressure were exceeded on one of the engines, and the copilot had to climb out on the wing to inspect the engine for possible damage.

After they had determined that the engine was okay and the cylinder head temperature had cooled, two more rather rough takeoffs were attempted, the second of which was successful. I was informed later that the sea state was at max limits for the HU-16 and if it had been any worse, the rescue would have been impossible.

One hour and 45 minutes later we were home safe and as much as I love the ocean and the Navy, the dry ground really felt good! On exiting the HU-16 I was greeted by several smiling faces and a glass of bourbon (for medicinal purposes) and was taken to the base dispensary where I was checked over thoroughly, outfitted with a pair of pajamas, and had my thumb sewn up.

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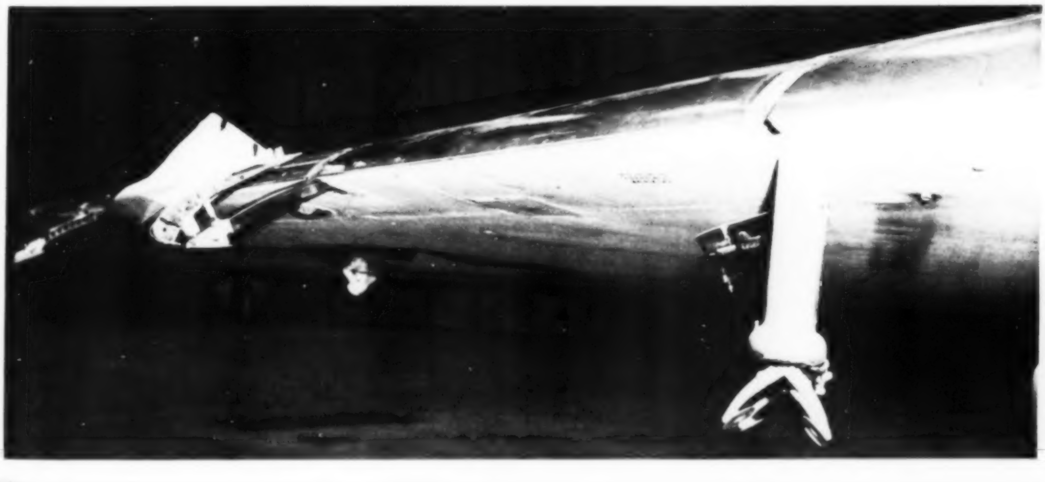
OVERSTRESSED PULLOUTS

A flight of four A-4Bs were conducting napalm bomb delivery practice. They passed over the target in a loose four-plane formation for identification purposes. Following this, the flight echeloned off into an attack column. The number 2 man in the column followed the leader for a shallow dive, low-level attack to lay the napalm on the mountain target. Speed brakes were retracted. Upon release, the *Skyhawk* was indicating 450 kts. The pilot suddenly realized he was dangerously low to clear the rocky peaks so he simultaneously horsed back on the stick and added considerable power. Shortly after assuming a nose-high attitude, the aircraft was felt to shudder violently. Upon regaining level flight, the pilot discovered that the leading edge slats had been ripped off of the A-4B by the overstressed pullout. An emergency but safe landing was made at a designated facility into the chain gear. After touchdown, aileron control was lost due to jamming of the aileron system.

Moral of this incident is: Even shallow high speed attack runs can be misjudged as to proximity to the ground.

Slats were ripped off by the high-G pullout. Fortunately the aileron did not jam until touchdown.



POP go the f

eflares

After normal takeoff and climbout on a cross-country flight that signaled the start of a short deployment, the SP-2E was boosted to 12,000 ft because of traffic. As the cold at altitude became more penetrating, the afterstation observer called forward and requested heat. Permission was granted, the Plane Captain lit off the heaters and in a short time the observer verified that he was receiving heat, and that the afterstation was becoming comfortable.

Uneventful flight continued for approximately one hour, at which time the same afterstation observer thought he heard a loud "pop" in the fuselage section aft of his station. He looked back immediately, but stated that at the time he did not see anything unusual.

During the next few hours, other crewmen and passengers who visited the afterstation also heard the loud "pops." Some, their curiosity aroused, even looked back into the tail cone. *No one, however, either investigated the noises more thoroughly or informed the pilots.*

After two more hours the afterstation observer heard three distinct "pops" at closely separated intervals. Misfortune had "knocked," and now it came to call. As the observer turned to look back, the entire after section of the fuselage and tail cone burst into flames. He ran forward and passed the word to the radio operator, who in turn, informed the pilots.

At this particular moment, the pilots were in the process of changing seats, so the copilot took immediate action. He set the mixture RICH, spark RETARD, dropped 10 degrees of FLAPS and informed the Center that he was going off the air. A quick switch of pilots, and now four hands were available in the cockpit. The pilot began an emergency VFR letdown to an airfield he'd spotted, while the copilot informed the crew that ICS would not be available and secured electrical power.

Up to this point, corrective action was prompt and efficient considering that information was sparse in the cockpit as to the seriousness of the fire, as well as its exact location in the afterstation. Communication now was by word of mouth, and the necessary information came slowly.

Back aft, the observer had already emptied three small CO_2 fire extinguishers on the blaze—to no avail—when the MAD cone suddenly ripped away from the aircraft. Even though "terrified," by his own admission, the observer managed to secure the luggage and loose gear while still tending to his own safety.

The surface wind was westerly, so the pilot circled

to a wide base for runway 26. Word was now passed to the crew that a landing was to be attempted.

At the 180, the copilot turned on d.c. power, lowered 20 FLAPS, pointed to the gear handle and the pilot dropped the gear. A.C. power was once again secured, and the checklist reviewed. On final, d.c. power was once again applied, the props set to FULL INCREASE RPM and FULL FLAPS selected. The runway was clear and the landing was uneventful.

On the rollout the tower, which had monitored the entire incident since the P-2 first appeared on the downwind trailing smoke, quickly directed fire-fighting equipment to the scene and advised the pilot to shut down on the runway. All crewmen exited by the forward hatch, and the fire was extinguished by the crash trucks.

Investigation placed the blame on the crew members, but no one can deny that in this case everyone concerned was just a little bit at fault. A few minor departures from accepted procedures, seasoned with just the right amount of complacency and lack of positive supervision set up a potential which even forewarned the crew that something out of the ordinary was about to happen.

The Setting

In preparation for the deployment, luggage was stowed in the nose tunnel and the afterstation. Since it was squadron policy to store mae wests somewhere other than in the aircraft, their absence wasn't missed until the Plane Captain remembered that they should be brought along for use on overwater flights at their destination. By then the normal stowage position, a horizontal bar, was taken up with suit bags. Loading of the mae wests occurred after most of the other luggage.

Since the normal stowage area was taken up, the Plane Captain at first directed that they be placed in the storage compartment beside the stove. This area was already filled with box lunches, however, and one of the crewmen hastened to add that it would be dangerous to stack them so near the stove. The Plane Captain finally handed the life vests up to someone in the afterstation who assured him that they would be stored aft of the rescue hatch and out of the way.

Without a second thought, the supposedly experienced crewman who loaded the vests piled them one on top of the other in the aft section of the fuselage, just forward of the aft heater outlet. He later recollected that it was "almost impossible to see the mae wests by just walking through the afterstation."

When the afterstation observer began to receive heat during the first part of the flight, he cleared some

Part of the burned out area showing almost a clear view aft.

loose gear from in front of the diffuser which was forward of his seat, but did not check the diffuser farther aft. The aft heater diffuser air control was later found to be open about one inch, allowing high velocity hot air to be directed into the mae wests below it on the walkway.

After one hour of heater operation, the first "pop" was heard in the afterstation. Periodically for the next two and one-half hours, the loud "pops" were heard by various crewmen as the heat soaking process exploded CO_2 cartridges in the life vests. Later investigation revealed that 21 out of 24 CO_2 cartridges had exploded. The observer's unaccountable lack of iniative to investigate, or at least to report these sounds, allowed events to build up to the irreversible point at which three short interval "pops" were followed closely by a sheet of flame.

The Result

After the fire was put out, inspection revealed the following damage. The tail cone and MAD boom had been ripped from the aircraft by the windstream when a small section on the left side of the

Aft fuselage heater diffuser, port side.

tail cone had burned through. In the immediate area of the fire, the discharge of Mk-13 Mod-0 signal flares had melted some of the aluminum structure on the bottom of the fuselage and had penetrated the skin in three places. The aluminum housing over the elevator quadrant on the starboard side had melted and exposed the quadrant to intense heat. It subsequently cracked when the last fire extinguisher was directed on it in an effort to keep the control cables and surfaces cool.

The fire itself was confined to the area of the aft fuselage heater diffuser. With the MAD cone gone, the chimney effect in the aft fuselage area added to the apparent intensity of the fire, but it also spread the heat over a large area, and thereby allowed a rapid cooling.

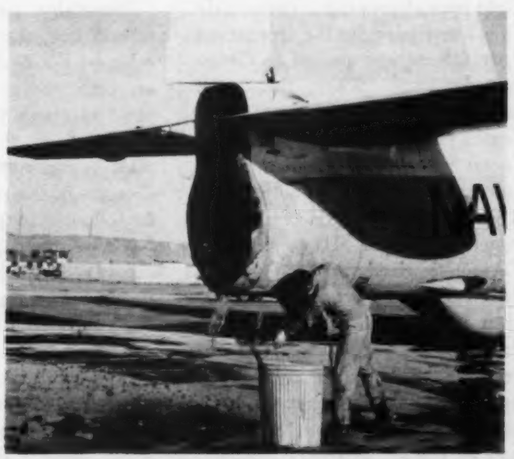
Inflight operations and tests of the aft cabin heater revealed that the mae wests were in the area of maximum possible high velocity hot air flow.

Inquiry and investigation concerning the ignition point of all components of the completely equipped Mk-2 life preservers indicated that the only com-

Mae west and Mk-13 flare debris.

ponent to which spontaneous combustion might result through heat soaking in the range of the SP-2E heaters, was the phosphorous-coated copper pull wire igniter of the Mk-13 Mod-0 day-night signal flare. Since combustion normally follows ignition, the result was practically inevitable. Of the 24 flares 21 were recovered. Of these 12 had ignited on both ends and 7 had ignited on the day end only. Two flares were lightly scorched but had not ignited on either end.

Since storage space is at a premium, loose gear in the afterstation has long been a problem in the venerable P-2. The horizontal bar mentioned above, when equipped with nondetachable hangars, has been used successfully for storage of both mae wests and parachute harnesses. As such, it serves to provide clean, efficient, out-of-the-way storage, and helps to prolong the service life of some pretty vital gear. Misused as a luggage rack, it could cause the untimely end of an otherwise uneventful day.



An easy way to clean the bilges . . . ?

Short Snorts

Experience proves that most time is wasted not in hours, but in minutes.

Check NOTAMS

The NOTAM read "Tacan out from 041200Z till 042000Z". This information was posted on the NOTAM board in the flight planning room of an East Coast NAS. In addition an 8 x 10 in. sign with the same words was posted on the flight planning desk directly over a safety poster which enjoined pilots to *plan, learn, anticipate* and *navigate*.

Our intrepid pilot filled out a flight plan requesting a Tacan SID. This was signed by the Operations Duty Officer and passed to Center for clearance. When the tower called Center for clearance, the Center clearance included the Tacan SID. The tower and departure control flight data both copied the SID, and clearance delivery issued the Tacan SID to the pilot. The pilot's climbout was issued by departure control as a right turn after takeoff and climb—via (Tacan SID). When airborne the pilot reported to departure control that he was unable to get a Tacan lock-on. No wonder, the Tacan was off the air all day.

This same day a UC-45J pilot filed in the same manner, receiving the same clearance and finally discovering when airborne that he didn't even have Tacan equipment in the aircraft.

Do you really check the NOTAMs or just the box on the 175?

Sneeb Snort

Faulty cockpit procedures and an improper briefing nearly retired another *Sneeb*, but the pilots of this one were lucky.

Hopefully anticipating a short takeoff run, the pilot of a UC-45J released the brakes, set full power on both engines, lingered a moment to check the gages then put his hand on the gear lever. The pilot in command, who was riding shotgun in the right seat, neglected to follow through with the proper backup. After 2000 ft of roll on runway 36, with the airspeed passing 60 kts, the starboard engine lost power and the aircraft swerved sharply to the right.

The pilot in the right seat immediately took control and noticed that with no one guarding it, the right throttle had worked back and was now approximately one-half retarded. Instead of aborting, he put his 600 *Sneeb* hours on the line and tried to straighten things out. A 30-degree left crosswind helped some, and with full power applied to both engines, he stopped the swerve on a heading of 060 degrees.

The aircraft left the runway and bounced and skidded nose high across two grass islands and a taxiway in an effort to get airborne. When it mushed in on a grass strip parallel to runway 06, the pilot held it down long enough to attain flying speed. After narrowly missing a crash truck, it finally staggered into the air across runway 06 following another swerve left to a heading of 025 degrees.

Inspection following an uneventful landing revealed only slight damage to the bird.

Midget-Maker

Item: PERSONNEL and visitors on board are walking under F-4B tail hooks. If this hook drops it will make a midget out of a giant.

Action: Where this practice is detected, correct on the spot. F-4 squadron to utilize up lock cables

on the hangar deck. Escort officers to caution visitors to stay away from F-4 tail hook area. Plan of the Day to carry warning concerning tail hooks and propellers.

—Safety Council Minutes

NATOPS Evaluation

While in a Tacan holding pattern during the instrument portion of a NATOPS Evaluation at MCAS Iwakuni the following events took place:

The P-2 was cleared to hold at 5000 ft by approach control. While in the holding pattern between the 5nm and 8nm DME fixes on the 110 radial, a Marine F-9 departed Iwakuni on an IFR clearance. Weather at the time was 10,000 broken and visibility 15 miles plus. The F-9 was cleared by APC to maintain 4000 ft on the 125 radial and report 10 miles. They were also advised of the P-2's presence.

Shortly after the F-9 took off, the P-2 was on the inbound leg of the holding pattern. The next thing the pilots and bow observer of the P-2 saw was an F-9 at the same altitude. The F-9 missed the P-2 by an estimated 100 ft—almost close enough to see the color of the pilot's eyes. APC was immediately informed and they replied that the F-9 was only cleared to 4000 ft. There was no rebuttal by the F-9 even though he was on the same frequency.

The moral of the story is watch out for IFR traffic on VFR days.

A Shook NATOPS Instructor

Hung Rocket

When the rocket on station nine failed to fire after several tries, the P-3A crew attempted to jettison it. The jettison cartridge fired normally but the rocket stayed on the wing. A no-reverse landing followed at homeplate and on the rollout, the 5-inch HVAR fell harmlessly to the runway.

It was later determined that during the jettison sequence, the aft suspension band had slipped forward on the rocket motor, but the rocket had remained attached to the Aero 15D rack by its forward button and was held in place by the slipstream. As the aircraft decelerated during the landing rollout the rocket moved forward, the suspension button disengaged and the rocket fell to the runway.

Trapped Foot

The crew of an F-4B was strapping in for a carrier deck launch and the RIO was having difficulty with a twisted shoulder strap for his parachute. The ejection seat trouble shooter was summoned to help. Meanwhile, to meet the takeoff schedule, the post starting engine checks were commenced. The ejection seat trouble shooter arrived and climbed up on the wing to help the RIO. The associated noise made voice communications difficult. In the course of events, the trouble shooter was standing on the starboard air intake duct when the plane captain gave the pilot the signal to extend the IFR probe. The trouble shooter suddenly felt his left foot being twisted. Then he started yelling that the extending probe was mashing his foot between the probe door and the starboard intake cheek.

The pilot and the plane captain could not see or hear the man. Fortunately his problem was quickly recognized by the RIO who transmitted over the ICS to the pilot "the probe, the probe." The pilot glanced out and saw the man's predicament. He stopped the probe extension movement and the trouble shooter was spared a broken foot.

This near accident was the result of incomplete communications. Once an aircraft is manned by the crew, other personnel desiring to mount the machine must be sure the flight crew and attending ground crew are fully informed of their intentions.

Tire Blowout on Takeoff

An F-4B pilot applied full power for an airfield takeoff. Two thousand ft down the runway one nose tire blew, unknown to the pilot. Shortly thereafter, the other dual nose tire collapsed. Simultaneously, the nose dropped and severe vibration commenced. Airspeed was then 130 kts. Correctly analyzing the trouble, the pilot then secured both engines and extended the hook. Quickly thereafter the *Phantom II* engaged the E-27 Mk-9 arresting gear about 20 ft to the right of the centerline. Speed had increased slightly to about 145 kts. No drag chute was deployed.

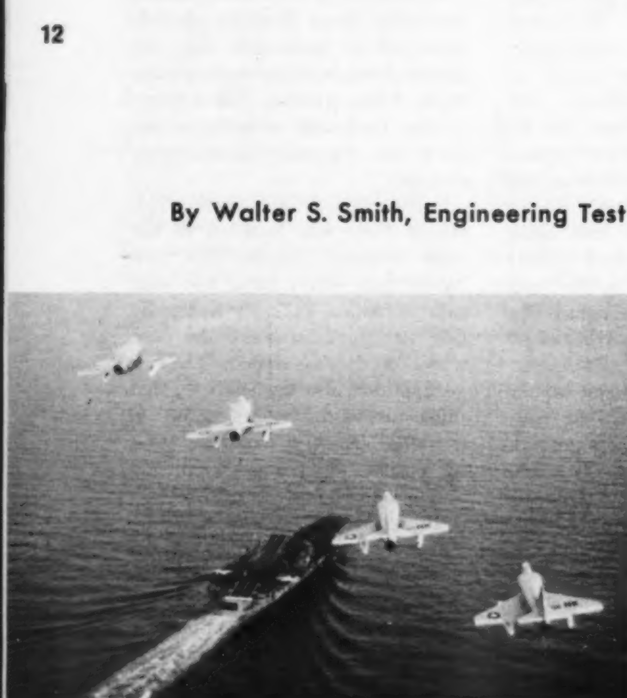
It took 1000 ft of wire runout to stop the beast. Then the aircraft was pulled backwards by the stretched-out emergency equipment. After rotating 150 degrees in the backward movement, the plane was stopped without further damage.

Subsequent investigation revealed FOD was ingested in the right engine. Besides the two blown nose wheel tires, the nose gear actuation cylinder hydraulic line was punctured and the nose wheel door was ripped. The investigation also concluded that other arresting cables 2000 ft down the runway from the takeoff position started the chain reaction by causing the tires to fail.

It would appear that the pilot made the proper reaction to the difficulty and saved an expensive airplane. Moreover, inspection of tires must be a never ending job to make sure that very necessary arresting cables do not get the best of overly worn and weak tires.

A-4E LONG RANGE CRUISE PERFORMANCE

By Walter S. Smith, Engineering Test Pilot-Flight Development, Douglas Aircraft



Engine Pressure Ratio (EPR) is more than just a go—no go gage for takeoff. EPR is a primary gage for establishing cruise performance. The problem of using EPR to establish cruise thrust is the difficulty in determining the value of EPR required. A brief review of cruise performance factors and a cruise kneeboard chart based on the cockpit indicators (including EPR) available to the A-4E pilot are presented herein. The information is applicable to other jet aircraft with twin compressor engines.

The interrelation between airframe aerodynamic drag, engine thrust and atmospheric conditions is the basic factor in determining cruise performance. Cruise performance is measured by the distance covered with a given amount of fuel $\frac{\text{(Nautical Miles)}}{\text{(Pounds of Fuel)}}$

and is referred to as specific range.

The aerodynamic drag for cruise conditions is determined by aircraft gross weight, configuration, altitude and Mach number. Gross weight and configuration are determined by the fuel remaining and the type and number of stores carried. When the large number of external stores that the A-4 is capable of carrying, i.e., fuel tanks, rocket pods, bombs, etc., is combined with its wide altitude and airspeed range, it is almost impossible to test the aircraft in every possible configuration to determine actual flight performance. Theory has shown and practice has demonstrated that the aerodynamic drag of the airplane is a function of: (1) the gross weight of the airplane (W) divided by the ratio of flight altitude static pressure with sea level altitude static pressure (δ-Delta), written W/δ; (2) the flight Mach number (M); and (3) a viscosity index called Reynolds Number (RN). The latter is usually a factor above altitudes of 35,000 ft. In cruise flight, the aircraft is assumed to be in a steady state condition; that is, at a constant altitude, neither accelerating nor decelerating, with the aerodynamic drag equal to engine net thrust (FN), or thrust required. The most common flight test technique used to determine specific range is to maintain W/δ constant for a given configuration and obtain data while stabilized at speeds between minimum and maximum Mach numbers. To maintain W/δ constant, it is necessary for δ to decrease as gross weight decreases because of fuel consumption. This requires climbing to higher altitudes. The data obtained forms the basis of the performance curves in the flight manual.

The net thrust for a given installation may be shown as a direct function of the engine's geometric design, inlet airflow conditions and exhaust conditions. The inlet conditions, compression ratio and fuel flow will determine the exhaust conditions. Therefore, for a fixed geometry engine, EPR, which is a measure of the inlet and exhaust pressures, will be proportional to net thrust for a specific Mach number and altitude. Because thrust is not measured directly, EPR is the primary thrust indication and will not be affected by component efficiencies or ambient temperature changes. Engine speed is a secondary thrust indication because RPM will vary between like models of the same engine even while they develop the same amount of thrust. This RPM variation is caused by manufacturing tolerances between individual engine components and varying friction loads. A calibrated thrust run is made to determine the engine speed required to produce the static rated thrust cor-

Outstanding birds for long range flights.

rected to standard sea level day conditions. The engine speed variation to obtain this rated thrust is made by a fuel control adjustment. The RPM that produces this standard rated thrust is that engine's "trim speed." The fuel control governs engine speed as a function of throttle position, but RPM may change to compensate for problems in other engine components. Also, net thrust does not vary uniformly with engine speed. In the normal operating range, a one percent RPM change causes about a five percent change in thrust; whereas, a one percent EPR change causes about a one and one-half percent change in thrust.

The atmospheric conditions that affect specific range are temperature, wind and altitude. Temperature is a major engine performance factor that is not available to the A-4 pilot in flight. The doppler navigation system gives accurate information for the pilot to modify airspeed to optimize cruise performance to account for head or tail winds.

Specific range will increase with altitude up to the optimum cruise altitude determined by the aircraft's configuration and gross weight. Above optimum cruise altitude, specific range decreases because of the large increase in thrust required with the resultant fuel flow increase. Operation at optimum cruise altitude and Mach number with high drag configurations will require close to maximum continuous thrust.

Maximum specific range, or the most efficient cruise condition, is obtained by climbing as aircraft weight decreases in order to maintain the optimum value of W/δ and Mach number for that configuration. There will be an excess of thrust as fuel is consumed for a constant power setting and Mach number. However, this excess thrust will be slightly less, because of lag effects, than the thrust required to maintain the optimum W/δ. Therefore, to maintain the most efficient cruise condition as fuel is consumed, it will be necesary to increase thrust slightly over that required for the optimum Mach number and altitude. The next most efficient cruise condition would be to maintain the optimum Mach number constant and allow the aircraft to climb as fuel is consumed.

Cruise efficiency would be further decreased if the aircraft were maintained at the constant altitude that was initially optimum and the Mach number decreased with fuel consumption; but, the efficiency will be significantly higher than it would be from maintaining a constant speed and altitude as weight decreased.

An increase in temperature above standard for a given altitude will require an increase in engine speed and fuel flow to maintain the thrust required for the desired Mach number. EPR, because it is a measure of net thrust, will not be affected by temperature and will have the same value for a given Mach number. Although it is necessary to increase fuel flow with an increase in temperature, the specific range will remain essentially the same because of the compensating increase in the true airspeed with temperature. Therefore, the effects of nonstandard temperatures will be compensated for by establishing cruise airspeeds with Mach number and thrust with EPR.

The cruise parameters that are presented to the pilots are the following:

Parameters	Value in Establishing Cruise
Mach Number	Primary; to establish cruise speed.
Altitude	Primary; to establish cruise altitude.
Angle of Attack	Secondary; to establish cruise speed. Sensitivity is poor (one unit equals about 25 knots at cruise speeds).
EPR	Primary; to establish cruise thrust.
RPM	Secondary; to establish cruise thrust (because of variances between engines and temperature effects).
Fuel Flow	Secondary; to establish cruise thrust (because of variances between engines and temperature effects).
EGT	A limiting operation condition that is an indication of engine efficiency work level.
Fuel Quantity	Primary; to determine gross weight required to establish cruise Mach number and optimum altitude.
Configuration	Primary; to determine drag index required to establish cruise Mach number and optimum altitude.

The chart below was constructed to present the primary long range cruise indicators simply. Long Range Cruise Speed is defined as the increased speed that occurs with a one percent reduction in maximum specific range. The small decrease in specific range is offset by the faster cruise speed (up to 0.1 Mach number) and greater maneuverability of the aircraft. High altitude maneuvering at maximum range air-

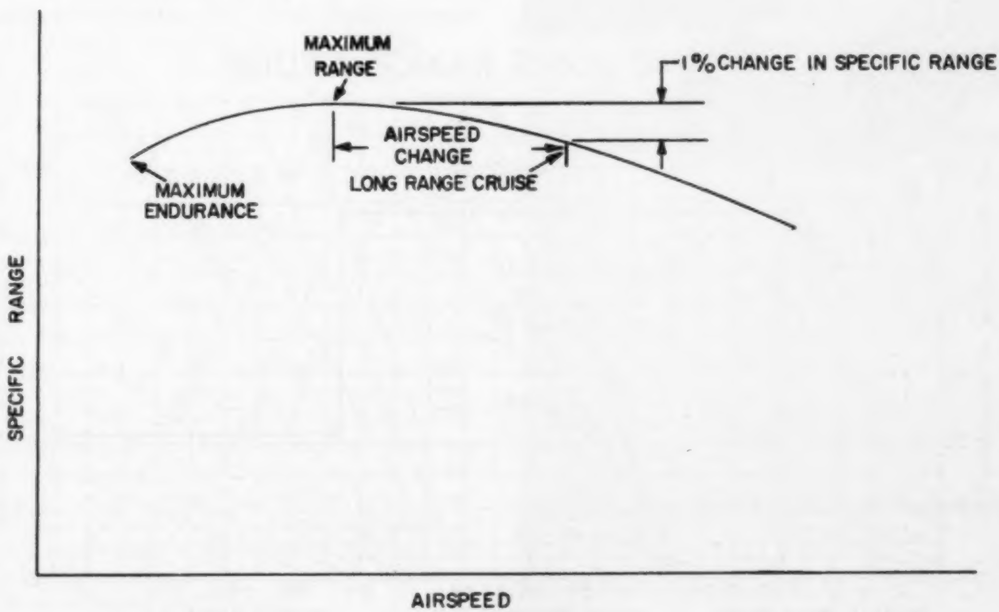


Figure 1

speed usually results in the airplane decelerating to an airspeed where a large amount of thrust for a long period of time will be required to regain the desired speed.

The construction of the chart below is based upon the addition of the drag of the clean airplane and the drag of the external stores equaling the total drag of the airplane, with compensation for the drag increase of the stores with increasing Mach number. A-4 Flight Test has demonstrated that this assumption is correct within about three percent.

The chart enables determination of the Mach number which will give long range cruise for any applicable altitude, gross weight and configuration. The optimum altitude for maximum long range cruise and the specific range for each configuration are also indicated. Once Mach number and configuration are determined, the EPR required to maintain this Mach number and specific range in nautical miles per 1000 pounds of fuel can be determined. As a convenience, the reciprocal of specific range—pounds of fuel per nautical mile, is also presented.

To use the chart, it is necessary to know aircraft gross weight and configuration:

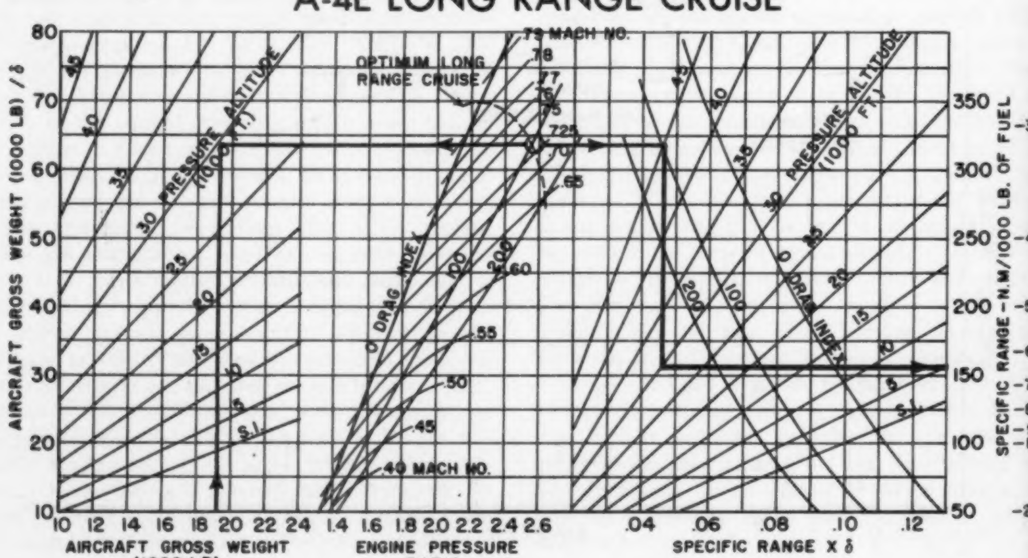
With airplane gross weight and the drag index, which is determined by type and number of external stores from the flight manual, it is possible to enter the chart with either a desired altitude, specific range, or Mach number.

Example: Airplane Gross Weight—19,200 pounds
Airplane Drag Index—100

Find: Optimum Altitude
Cruise Mach Number
Specific Range

Enter the center plot at the intersection of the optimum long range cruise line and the 100 drag index

A-4E LONG RANGE CRUISE



line. Extend this point horizontally to the left until it intersects with the vertical line for airplane gross weight of 19,200 pounds and read the optimum pressure altitude of 30,000 ft. The cruise Mach number is interpolated between the Mach lines on the center plot as 0.73. The EPR required to maintain this Mach number is found directly below this intersection as 2.56. It is necessary to be at or above the cruise Mach number before the chart EPR value can be set. The aircraft will not accelerate to the desired cruise Mach number if the cruise EPR is set at a speed below the cruise Mach number. Extend this point horizontally to the right from the intersection of the optimum long range cruise line and the 100 drag index line of the center plot to the 100 drag index line on the right-hand plot. At this intersection, move vertically to intercept the altitude diagonal (30,000 ft). Horizontally to the right from this intersection will give the specific range in nautical miles per thousand pounds of fuel (155), or the reciprocal, pounds of fuel per nautical mile (6.45). No significance should be placed on the intersection of the altitude lines with the drag index lines of the right-hand chart. The plot was superimposed to reduce the size of the chart. If desired, fuel flow can be computed from the following:

Fuel Flow (pph) = True Airspeed (knots) x Pounds of Fuel per Nautical Mile.

True Airspeed is determined from Mach number and actual or standard cruise altitude temperature on any air navigation computer with a Mach index.

If it is necessary to remain at a constant altitude, it will be necessary to reduce airspeed as aircraft weight decreases to maintain long range cruise. In the example above, when aircraft weight is reduced to 16,000 pounds, the Mach number should be 0.70. The specific range will be 182 nautical miles per 1000 pounds of fuel, an increase of 12 percent. If it were possible to climb as weight decreased, the Mach number would not change from 0.73. The optimum altitude for an airplane gross weight of 16,000 pounds and a drag count of 100 would be 34,000 ft.

Once the cruise altitude is determined, the primary cruise parameter for a given gross weight and configuration is Mach number. The chart value of EPR should maintain the cruise Mach number. However, if the chart value of EPR fails to maintain the cruise airspeed because of instrument, configuration or gross weight error, thrust should be added as required to maintain the determined Mach number. Fuel flow and EGT should be cross-checked for possible engine or individual instrument malfunction.

SANDBLOWER

Low level terrain-following flight deters radar detection

In this day of radar controlled anti-aircraft guns and surface to air missiles (SAMs), combat air operations over enemy territory are more hazardous than ever. But any time radar is masked by terrain, it is useless. Consequently, flying close to the surface allows enemy radars the least amount of time to detect and boresight air invaders. At first glance low altitude penetrations would seem extremely easy and safe. Unfortunately, peculiarities of nap-of-the-earth flying compound the problems.

Jet aircraft operating speeds and range are reduced in direct proportion to flight level. That is to say, the lower the altitude, the slower the speed and the shorter the range. Moreover, speeds close to the supersonic are difficult to attain in the dense air (high-Q) close to sea level. Additionally, if any turbulence is present (which it often is), the combination with high-Q can cause the strength of aircraft structures to be exceeded.

While deterring radar detection, the close proximity to the earth makes it difficult for the pilot to navigate because his field of vision is limited (as opposed to being able to see more at greater heights). This in turn often makes it difficult for the pilot to see terrain obstacles in sufficient time to avoid them. Two recent *Skyhawk Sandblower* missions clearly point out these difficulties.

Two A-4C aircraft were practicing an "Out and In" navigation training flight. The first part was flown at high altitude for fuel economy and the last part called for a low altitude penetration to simulate a minimum low level attack. The less experienced pilot led the low level last phase of the mission after being thoroughly briefed by the chase pilot concerning terrain obstacles known to be peculiar to the local area. Some high tension wires at 1100 ft MSL (over a bay) were specifically noted.

After sighting and passing close over the specified 1100 ft electrical cables, the junior pilot descended to 500 ft according to plan. Area visibility was noted to be about 30 miles. The chase pilot was apparently more concerned about something besides his location and altitude because a few moments later, he felt his *Skyhawk* strike something. Fortunately, he was able to retain control. Airborne inspection and experimentation indicated the damage would not prevent a safe landing which was subsequently made at home base.

Ground inspection revealed that the damaged A-4C had almost lost a battle with a power line approximately 150 ft above sea level. Its location had been sluffed over because the mission was to stay at 500 ft.

Another A-4C was not so fortunate. Leading a chase pilot, the ill fated *Skyhawk* pilot was on an approved *Sandblower* navigation training mission. The route was planned to be over the ocean (and generally parallel to the shoreline) in close proximity to mountainous terrain. When the course again led back over the land, the flight was at 200 ft. A thin cloud (fog) layer at about 800 ft was close to the

INTRUSION

ompounds navigation and obstacle avoidance. . . .

land but did not obscure it.

Assuming that the lead pilot could also see the rapidly rising landscape, the chase pilot did not become alarmed (in the short interval of time) until he thought he should initiate his own climb to be comfortably clear of the rising terrain mass. Then he made two quick transmissions to the lead pilot to pull up. Immediately thereafter he lost sight of the lead plane in order to save himself.

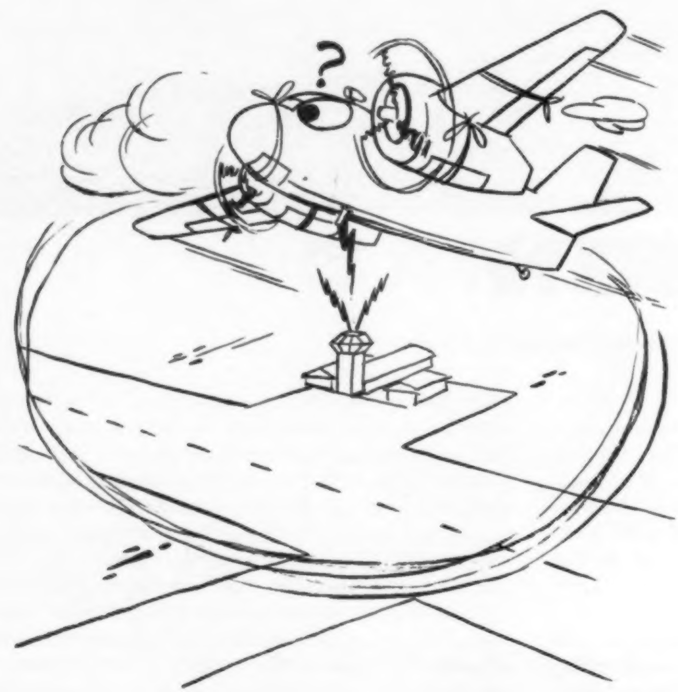
The lead pilot did ultimately commence a pull-up but timing was poor in that he struck the rising rocks at about the 800 ft level. There was no evidence that he attempted to eject.

In regard to the first incident, it was concluded that "complacency, an adversary as old as flying itself, lured another pilot into a trap. In this instance, the pilot was extremely fortunate to escape injury and possible loss of his aircraft. Had the guidance of NATOPS been rigidly adhered to, the mishap may not have occurred. . . ." There was a reference to the fact that if installed, radar altimeters can be useful but with 30 miles of visibility, lack of pilot alertness seems to be the missing item. For a mission briefed for a minimum altitude of 500 ft, it seems strange that 150 ft was the actual altitude because in such good weather, most pilots can eyeball the difference.

The primary cause of the fatal accident was undetermined. When the pilot saw the coast and its mountainous backdrop clearly, he most probably recognized that he was not proceeding towards his pre-selected coast-in point. It is assumed that he became distracted momentarily by this fact and directed his attention to his charts and possibly to his APG-53 radar in an attempt to locate his position. It can also be assumed that his failure to respond to the calls from his chase pilot was a result of preoccupation with his charts until it was too late to clear the sharply rising terrain. The existing weather prevented the ill fated pilot from seeing the top of the coastal ridge line and added to his difficulties in orienting himself. Forward visibility was more than sufficient to allow the pilot to observe that he was getting dangerously close to the steep hills. This, coupled with the timely radio transmissions from the chase pilot should have been enough to prevent the accident.

Both the incident and the accident reveal the need for additional supervision. It must be constantly reiterated to all pilots on *Sandblower* missions that they must evaluate procedures for maintaining safe terrain clearance and thereby prevent situations similar to the above. Thorough briefings, complete preflight planning and alert chase pilots are mandatory. More accurate and improved altimeters will always be useful for such minimum altitude operations. They can not, however, prevent pilots from flying into objects sticking up from sea level. Although complacency and preoccupation contributed to the above mentioned difficulties, it is hard to imagine *Sandblower* pilots being in league with them.

WELL DONE



On a planned night solo flight in a TS-2F, two flight students experienced complete hydraulic failure shortly after takeoff. They immediately advised Corpus Christi Departure Control of their difficulties, then turned back towards Navy Corpus and initiated trouble shooting procedures.

On investigation they determined that neither the landing gear nor the flaps could be lowered by normal means. The students declared an emergency via the control tower and established communications with maintenance personnel from the squadron. Some discussion later, the decision was made to manually pump the gear down utilizing the emergency hydraulic system. After the required amount of elbow grease was expended, all three wheels indicated and visually checked DOWN and LOCKED. The subsequent landing was uneventful.

Although this may appear to be a semi-routine operation to experienced pilots, it reflects the thorough training and indoctrination that flight students receive to handle such emergencies. Their prompt response to this unfamiliar situation, as well as their proper handling of it, are highly commendable. What could have been a major aircraft accident was handled in a professional and thorough manner by two relatively inexperienced student pilots, and VT-27's long safety record was held intact.

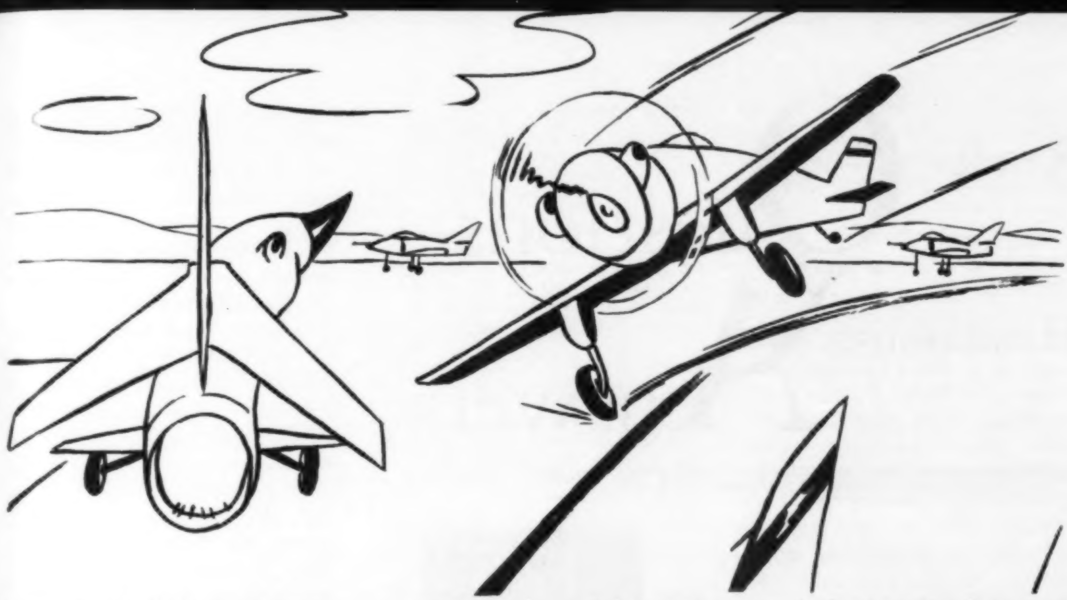
Night Phantom

After MOREST and then taxiing to the end of the runway upon completing a night TPQ mission, I nearly collided with an unlighted *Phantom II* (F-4C). The ghost was parked and abandoned between the dual runways on an interconnected taxiway. Subsequent investigation only invoked a weak apology about not having it marked by some lights.

Of course my face was not clean

The purpose of an Anymouse (anonymous) Report is to help detect or prevent a potentially dangerous situation. They are submitted by Naval and Marine Corps aviation personnel who have had hazardous or unsafe aviation experiences. As the name indicates these reports need not be signed. Self-mailing Anymouse forms are available in readyrooms and line shacks or through your ASO. All reports are reviewed for appropriate action.

— REPORT AN INCIDENT, PREVENT AN ACCIDENT —



because my taxi light was inoperative. Thanks to a quarter moon, I saw the obstruction just in time to avoid my first crunch.

ENLIGHTENED MOUSE

Safe Landings are Part of the Job

Entering the break, I had loosened the throttle friction control of my *Skyraider*, having found it too tight for proper positioning.

The break and landing phase were quite uneventful. On rollout I found myself too fast for the first turnoff and knowing that I was being followed in the pattern by two A-4s, I smartly added power in order to expedite my rollout to the 6000 ft turnoff. After commencing the turn at the 6000 ft turnoff I suddenly realized that my speed was excessive. The aircraft started to ground loop, but with judicious application of controls I was able to make the turn and stay on the taxiway.

My next step was to reach for the flap handle. I had been holding on to the left side of the seat during the hairy turnoff! My left hand struck the throttle as I was reaching for the flaps. Almost immediately the throttle advanced to somewhere above and beyond 20″ MAP. An instant left turn started which I counteracted with immediate right brake and throttle reduction. My actions were not quick enough however to prevent the port main mount from leaving the taxiway and passing, luckily, outboard of a taxi light before again regaining its proper place on the taxiway. Only extremely hard ground and excess taxi speed kept the aircraft from sinking as the main mount left the runway.

Recommendations: 1. Set the friction control well before entering the break. 2. Don't worry about the guy behind you *too much*. He may have to go around, but you won't wind up at the turnoff still doing X knots above proper turnoff speed. 3. Always remember that tailwheel aircraft cannot be turned as quickly as tricycle type. 4. Any turnoff speed you would use for jet, T-28, etc. divide in half for the "Spad."

Stray Rocket

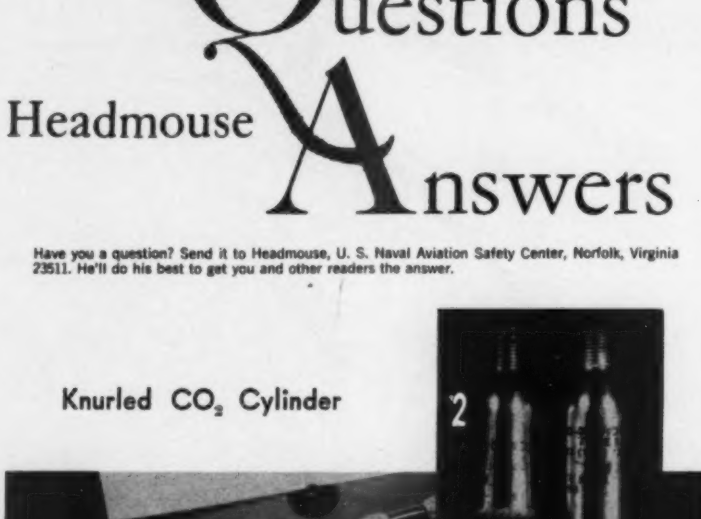
Having recently joined an attack squadron equipped with *Skyhawk* aircraft, I looked forward to ordnance practice. After a thorough briefing we manned our aircraft. I was assigned the number 2 position in a division of four A-4s. After a dummy run to positively identify the target, I set my panel to fire the 2.25 rockets one at a time. I was elated with seeing my missile hit close to the target. On the pullout, I shifted my gaze to the instrument panel and noted 4½ G registering upon approaching about a 40 deg nose high attitude. I was holding the stick with a straight back pull when I felt it begin to slip forward from my grip and I inadvertently tripped the rocket trigger. In proper response, one more rocket whispered out ahead of me and came very close to my leader out in front a few hundred yards. The runaway missile quickly disappeared into the blue in front of all of us doing no harm.

Meanwhile, back at the ranch; I mean later, back at the ready room, strong words were spoken and I learned several lessons: (1) Turn off the master armament switch ASAP after shooting a rocket (at the target, not your leader), (2) On high-G pullouts, use a stronger circular grip on the stick.

Reader Questions Headmouse Answers

Have you a question? Send it to Headmouse, U. S. Naval Aviation Safety Center, Norfolk, Virginia 23511. He'll do his best to get you and other readers the answer.

Knurled CO_2 Cylinder



Dear Headmouse:

Interim Clothing and Survival Equipment Bulletin No. 8 directed the removal of all set screws from the CO_2 inflator assembly on Mk-2 life preservers. The reason for this change is to enable personnel to quickly remove the cartridge and deflate the life preserver in the event of accidental inflight inflation.

The present cylinders are difficult to seat properly because of their slick surface. Preflight inspection requires removal of the cartridge and visual inspection. Because of the slickness of the cartridge material, the chances of not correctly seating the CO_2 cartridge are greatly increased. This is substantiated by tests in which preflighted preservers failed to inflate due to improperly seated cartridges.

To correct this problem, the shoulder of the CO_2 cylinder should be made more tractional. This can be accomplished by several means. Photo 1 shows a CO_2 cylinder installed with the end knurled to enhance traction. Knurling the cylinder is inexpensive and can be accomplished at a local level. Photo 2 shows the CO_2 cylinder before and after knurling.

PR1 H. E. LAINE
NAS SEATTLE

▶ Good idea. We are forwarding your proposal to the Naval Air Systems Command Headquarters.

Very resp'y,

Headmouse

Orange Suit and Sharks

Dear Headmouse:

There is considerable scuttlebutt around that orange flight suits attract sharks. Please comment.

LCDR NOEL N. PEDERSON
ASO, VAP-62

▶ Your question is one which we doubt can be answered with any certainty because there are too many unknowns about shark behavior at the present time and too many variables. However, a passage from the final report of the *Test of the Naval Ordnance Test Center Shark Attack Deterrent Device*, University of Hawaii, 15 August 1966, is of interest here.

Marine investigators working through the Shark Research Panel under the auspices of the Office of Naval Research tested the concept of a protective bag made of strong, impermeable fabric to isolate a survivor from shark infested waters. Tests were conducted on captive sharks at the Hawaii Institute of Marine Biology and on free living sharks at the Eniwetok Marine Biological Laboratory in the Marshall Islands. "The color of the bag (per se) seems unimportant," the report states, "but the reflectivity of the bag seems very important." The sharks worked with were of medium size, mostly five to seven feet, and the question of whether larger free-living sharks, such as the tiger, mako and great white shark would attack the bag is still unresolved.

Essentially the shark protective screen is a strong impermeable plastic bag, 27 in x 5 ft, weighing about one pound. The Office of Naval Research states that the screen body should be black and the buoyancy rings at the top an international orange for visibility (to rescuers). These rings are fitted with oral inflation tubes.

Once in the water, the swimmer detaches the screen, fills it with water, crawls inside and inflates the buoyancy rings. He is then protected from the ocean. If he is wounded, none of the blood will escape into the ocean to attract marine life. Supported by his life jacket and the buoyancy of the

screen, he has a probability of survival much greater than floating unprotected in the water.

Very resp'y,

Headmouse

New Discovery

Dear Headmouse:

This unit has recently "discovered" an oxygen/smoke mask which is a Navy stock item. We have been interested in this particular type item for some time. Now that we have learned of its existence a few of our people have raised a point that it may not be acceptable.

I envisioned that this mask would suffice for use in the HC-130B and HU-16E aircraft with the portable walk-around oxygen bottles. During inflight emergencies, we do not presently have adequate protection from the eye irritation factor of smoke. It is a possibility that this mask could also be used at the flight stations.

Please furnish any information you have which indicates that this mask is *not* suitable for use by crew members in combating inflight fires and smoke emergency situations.

LCDR H. U. WILSON
CGAS BARBER'S POINT, HAWAII

▶ The oxygen/smoke mask you describe is currently installed in P-3 aircraft. Its users have expressed dissatisfaction with the mask because of its bulky stowage requirements and the difficulty involved in retrieving, donning and adjusting it properly. It is particularly unsuitable for use as you describe it because of its tendency to fog up completely during actual use.

Replacement of the mask was discussed at the Navy/Lockheed Safety Symposium during November 1966. As a result, NavAirSysCom has been requested to design an improved smoke mask compatible with patrol type hard hats and, as an interim measure, to replace the current model with the A-13A oxygen mask equipped with a quick-donning harness.

Very resp'y,

Headmouse

Strobe Light

Dear Headmouse:

A question has arisen as to the shelf life of strobe light batteries (battery, mercury 4RM1B, manufactured by ACR Corporation, New York, N.Y.). No one seems to know just how long these batteries will last or how to insure that they will work when it comes time for them to do the job they were designed for in an emergency where a pilot's life may depend on the light's proper operation.

We would like to have some idea of how often these batteries should be changed or how they can be tested. We don't want our pilots left up in the air (or down in the water) wondering if their strobe lights will work if and when it becomes necessary. Any information you can give us on the shelf life or a valid test of strobe light batteries will be greatly appreciated.

AMH2 I. W. CRUPPER
VA-112 QUALITY CONTROL

▶ As yet no test has been published by the Navy for the ACR-4F mercury battery (the 4RM1B you refer to) used in the SDU-5/E strobe light. This battery module is made up of four mercury cells wired in series. The low internal resistance of mercury batteries provides a relatively steady voltage discharge; thus uniform power output is continuous throughout the life of the battery. Signal Corps tests of this type of cell indicated that if stored at temperatures of 30°F. to 75°F. then 85% of capacity is retained for periods up to five years. High temperature storage will cause battery capacity to drop appreciably.

A schematic diagram for battery testing as recommended by the manufacturers appeared in both *Personal/Survival Equipment Crossfeed*, April, 1966, and *Maintenance Crossfeed*, March, 1966. The manufacturer recommends the test be complied with at least every 90 days after the unit has been placed in service and prior to placing a new battery into service. The acceptable minimum for service life remaining should be set by the user until such time as the Naval Air Systems Command Headquarters establishes a standard.

Very resp'y

Headmouse

Airman's Work

Dear Headmouse:

It is my impression that ejection seats constitute enough potential danger that no one should work on them but AMEs. And the only way to become an AME is to go to AME school.

Yet, nondesignated airmen are detailed to help install seats even though they have no knowledge of ejection seats.

It seems to me that if there aren't enough AMEs to do this type of work, then they should request more.

NON-D AIRMAN

▶ Your first impression is pretty close to being correct. Ejection seat maintenance and installation is serious business requiring extensive knowledge of the hardware, the finest care and the application of all safety precautions. To insure safety and reliability of an installation the work must be fully supervised by a fully qualified AME. The shortage of experienced personnel in the AME field and in many other ratings places a greater burden on supervisors.

Although BuPers Inst 1430.7D lists the AME rating as one requiring formal schooling for advancement it does not preclude the use of airmen as a general hand. There's an old proverb which seems to be written especially for nondesignated airmen "All things come to him who waiteth—provided he worketh like hell while he waiteth."

Very resp'y,

Headmouse

THE EYES HAVE IT

U.S.S. ENTERPRISE CVAN 65
MEMORANDUM

1-10-67
Yankee Station

FROM: Air Officer
To: NavAvnSafeCen

1. Attached photo of handsome young sailor is graphic proof of the value of goggles to flight deck personnel. Para G discusses how he got his burns. The Doc says he'll be handsome again in a few days.

2. We have some trouble convincing people to use the equipment that is available. Comfort and visibility are important to all of us, and it's easy to figure that you'll have time to take cover or pull your goggles down if something unexpected happens. But 'tain't so all the time -- and not for the guy in the photo: it all happened too quickly.

3. The Air Boss can't do it for you on the 5MC. What's needed is on-scene enforcement of complete flight deck uniform, by officers and POs. Pilots especially have a responsibility to their maintenance crews to train them in safe procedures, and to require safe performance. ASOs can help a great deal by insuring that new people understand the dangers.

V/Resp'y

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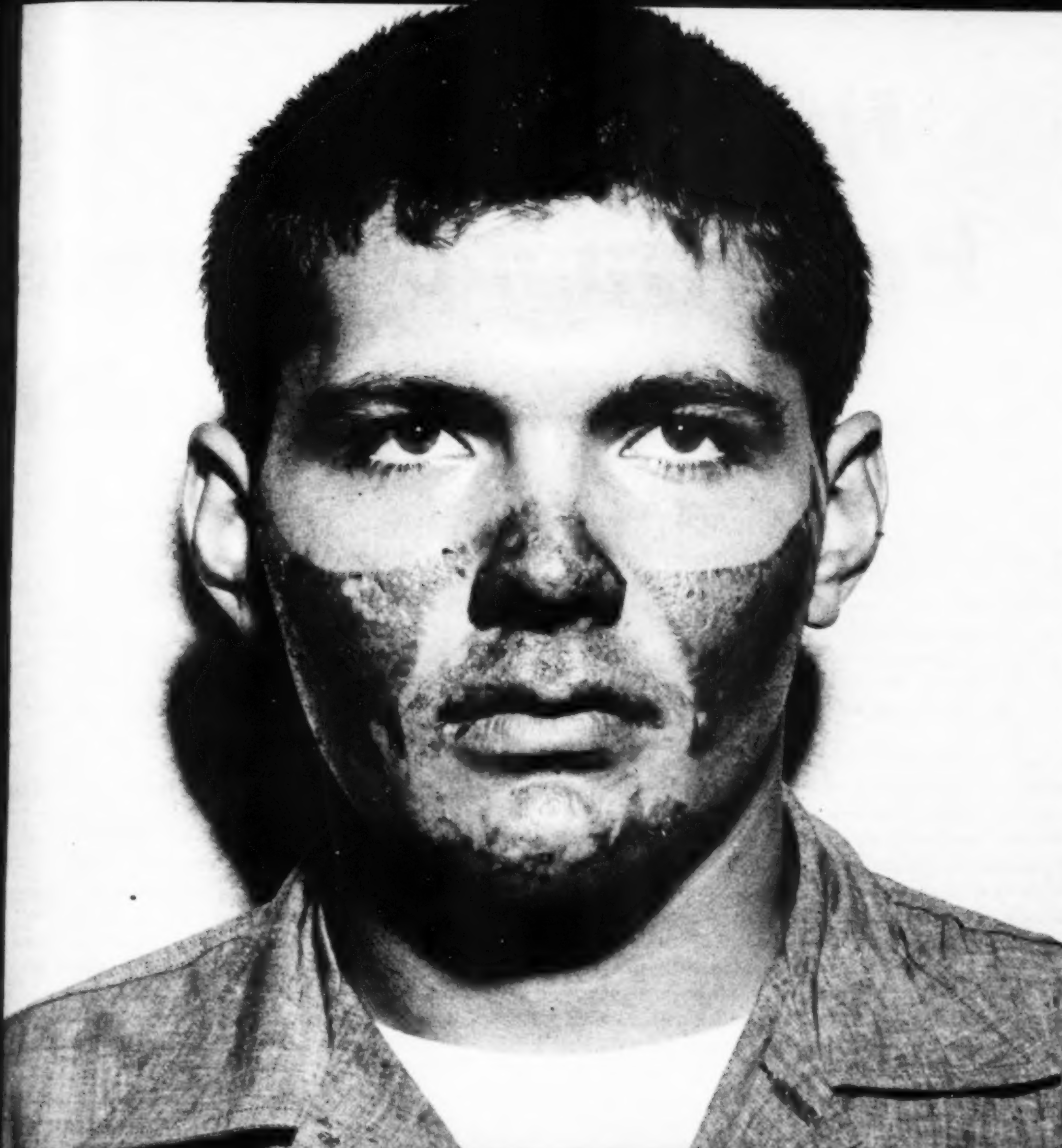


G. Suspect the bridle lanyards failed at end of normal afterburner launch on number three catapult and allowed bridle and swage fitting to whip, causing massive rupture of centerline tank and damage to door 82L and sparrow missile on station seven. Spilled fuel was immediately ignited by aircraft's afterburners and fire engulfed ship's angle bow. Fire burned itself out within 15-20 seconds. Aircraft continued climbout, retaining tank. Waist catapult bridle runner stationed in catwalk received superficial burns about the face. His injuries were minor due to wearing of goggles and head gear. Damage to ship limited to scorched paint around angle bow. Aircraft recovered aboard with centerline tank still attached.

High Performance Flyers for

By DR J.R. McTammany and CDR A.J. Toth

At the end of a long arching trail of smoke the pilot saw his disabled aircraft explode in a huge ball of flame when it hit the side of a hill. All was very quiet as he floated earthward in his parachute except for some small arms fire to the north. He had tried to maneuver his damaged plane toward the ocean, but when his controls failed completely, he had been forced to eject.

Suddenly, when several rounds penetrated his parachute canopy, he realized that the shooting below was being directed at him. As the ground rushed up, the pilot estimated that the ocean was about 10 miles to the east. In a clearing to the north he saw about a dozen enemy who were running in his direction and firing at him. He landed hard about 300 yards ahead of his pursuers as rifle rounds kicked up dirt around him. Realizing that his only chance was to run and keep running, he quickly ducked into the trees nearby. Keeping the setting sun behind him, he headed for the ocean. He could hear the enemy chasing him and occasionally bullets crashed through the jungle around him. For the next hour he moved as fast as he could through the dense growth and scattered clearings, gradually increasing the distance between himself and the enemy. He finally made it to a narrow strip of beach where he was picked up by a helo just as the enemy broke out into the open, firing after the departing aircraft.

The successful outcome of this episode was not determined at the moment of the rescue but several years earlier, in a flight surgeon's office back in the United States. The young officer had been unable to pass his annual flight physical because of being overweight. The doc's explanation of eating habits, health and physical conditioning had made sense. He agreed that he had "slipped some" since the days of flight training, and that about 20 pounds had somehow appeared around his middle though he hadn't really been eating so much. And he had noted that even after easy days in the squadron he found himself quite fatigued and rarely inclined to work in the yard or help the little wife with chores. In fact, he had been puzzled that almost any physical activity left him tired all the time. Also, his wife had commented that he seemed irritable and no longer interested in things which he used to enjoy.

The flight surgeon had explained that all of these symptoms and more may be caused by a state of metabolic imbalance resulting primarily from improper eating, too little exercise, and excessive smoking. He began, that very day, a physical reconditioning program which he was surprised to discover he enjoyed very much, and through which he developed his strength and endurance to the extent that he could sprint those 10 grueling miles over the worst terrain and literally outrun his would-be captors to make good his escape.*

Downhill Slide

Such ability is but one of many benefits to be derived from getting and keeping oneself in good physical condition. In recent years a great deal of thought, study and research in centers the world over has given rise to some very startling facts on the subject.

Considering the overall physical condition profile of the American male, Dr. T. K. Cureton of the Physical Fitness Research Laboratory at the University of Illinois has observed that all "fitness curves" increase until about age 17 years, level out during an "adolescent plateau" until about age 26

*This episode is a fictionalized version of a story told by pilots in an air group upon their return from combat.

Dr. McTammany, until recently a naval flight surgeon, and Cdr Toth, a naval aviator, have been interested in the subject of physical conditioning for a number of years. This article is the result of their extensive study and experience, and has been especially written to apply to the specific needs and abilities of those in naval aviation.

Modern Aircraft

years and then begin a long middle-aged downhill slide. Dr. Cureton emphasizes that physical fitness is more than just an absence of illness—it is a way of life in which there is ample energy, enthusiasm and endurance for living a robust, productive, gratifying life, working hard as well as playing hard.

Integrated System

In other research at the University of Illinois, it has been shown that as physical characteristics such as muscular strength, reaction time, endurance and respiratory capacity all worsen with age, there are concomitant changes for the worse in mental abilities, emotions and personality traits. Mental abilities which decline are computational speed, memory, mental energy, mental adjustment to new situations, ability to relax and reasoning. Changing personality traits are loss of physical courage, decreased extroversion or increased introversion, fear of loss of health and preoccupation with money and responsibility.

The studies of Betz, Wells and Breen bear out these observations. These studies showed that the greater a person's ability to run "all out" on a treadmill, the less his anxiety, fear for self, mental fatigue, tendency to overeat and other undesirable factors. Therefore, it has become quite apparent to researchers in the field that *the human being is an "integrated system" in which physical factors, mental factors, emotional factors and personality factors are all interrelated and that whenever one area is influenced favorably or adversely the others show corresponding changes.*

More Immediate Effects

In addition to preventing this physical and mental deterioration with age, physical conditioning has many other and more immediate effects: personal appearance, strength, endurance, mental ability and emotional stability are actually improved. Furthermore, as the authors of the book, *Hypokinetic Disease*, Drs. Hans Krause and Wilhelm Raab, have reported, there is much less trouble with sprains, strains, dislocations, back pain and various other muscle and joint ailments among people who stay in good shape. Headaches, indigestion, fatigue, colds and other troublesome conditions occur much less frequently.

A major benefit is the improvement seen in the functioning of the heart and blood vessels. Hundreds of thousands of productive men die annually in the United States because of "heart attacks." This great loss could be substantially reduced through regular exercise, proper food and less tobacco.

Promotional Advantage

For the naval officer, all of this means many things: more energy and enthusiasm for each day's work and each flight, reserve strength and endurance for survival in the worst of conditions, improved performance and leadership which will be reflected in evaluations by senior officers and improved command potential as the years pass and experience accumulates.

Continued

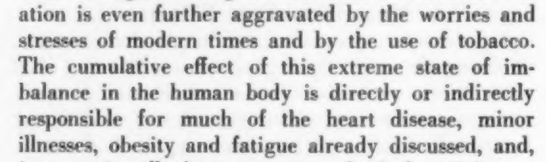
How can such a simple thing as physical exercise bring about these great changes in body function? The complete details have not yet been worked out in the laboratory, but many facts are known. The work of numerous investigators has shown that the various systems of the body are regulated by the balanced action of certain chemicals in the blood. The challenges, stresses and tensions of living cause the release of adrenalin into the bloodstream. A neutralizing or equalizing effect results from physical activity which restores the body to a state of metabolic balance.

Excessive Adrenalin

In centuries past, the human animal has responded to life's challenges and threats by fleeing to escape, fighting to destroy or laboring to accommodate—all requiring physical activity. In recent times, fleeing, fighting and adapting have all been largely mechanized through the use of vehicles, weapons, and a multitude of machines and appliances, all of which reduce or eliminate the need for physical exertion. Consequently, adrenalin in the blood is not "used up," but remains in excessive quantities and causes a state in the body similar to that in a motionless automobile with its engine racing at maximum RPM. This situation is even further aggravated by the worries and stresses of modern times and by the use of tobacco. The cumulative effect of this extreme state of imbalance in the human body is directly or indirectly responsible for much of the heart disease, minor illnesses, obesity and fatigue already discussed, and, just as in all the ages past, physical activity or exercise of the proper type restores the body to a state of metabolic balance with all the resulting benefits.

Push-Button Civilization

The picture is vividly described by Dr. Theodore G. Klump in the magazine, *Think:* "It is becoming increasingly evident that the real culprit in this picture is the push-button civilization which our scientists and businessmen have created. With the bountiful blessings of labor saving devices, our ex-college athlete can sit all day long, doing little that is more strenuous than answering the telephone or walking to the water cooler. He escapes three times a day by eating fine groceries, and while he grows fatter, his heart muscles and glands degenerate and stagnate, as he drives home from work with power steering. He takes the half dozen steps from his car to his cocktail shaker, more tired than he used to feel after five sets of tennis. In a melancholy mood he tells himself that he is growing old and that a drink is the only solution. And as the years roll on he has forgotten that his 'office fatigue' can be miraculously dispelled with a little exercise if he can find the will power to try it."



Dr. Cureton states, "It can be said that exercise is decidedly beneficial, and, in fact, is so beneficial that in the search for ways and means to counteract the mental and emotional stresses of business and urban life, exercise of the right kind is man's best insurance."

How To Go About It

Granted, then, that it would be wise to embark on a program of physical reconditioning as did the pilot at the beginning of the article, how does one go about it? What exercises should be done? What food eaten? What type of sports are good?

First the *exercise*: There are different types of exercises and they have differing effects upon the body. They may be considered in three categories according to their effects: *muscle strength exercises, agility exercises* which improve balance, coordination and timing, and *endurance exercises* which improve the function of the heart, lungs and blood vessels.

Three Types of Exercise

Muscle strength exercises are those which put great tension on the muscles for brief periods of time such as weight lifting; more difficult calisthenics like chins, push-ups and dips on parallel bars; and gymnastic exercises requiring weight bearing of the entire body such as on the parallel bars, side horse, horizontal bar or in rope climbing. The emphasis is on the total resistance sustained by the muscle and less on duration or many repetitions. The results, which may be seen quickly, are an increase in physical strength making heavy work easier and an improvement in physical appearance due to the redevelopment of long dormant muscle groups. This routine may be varied to improve individual muscle flexibility and endurance by: placing less emphasis on total muscle tension or resistance and more on many repetitions, as may be done with lighter weights; easier calisthenics like jumping jacks, running in place, twisting and bending exercises; and gymnastics such as tumbling, free exercise or flying rings. As an example, with weights, muscular strength would be developed by choosing a weight which could just be lifted five or six times whereas individual muscle flexibility and endurance would be more improved by using a lighter

weight and lifting it several dozen times. Specific muscle exercises may be chosen for any muscle group in particular need of developing.

Agility exercises are somewhat different. They include skating, downhill skiing, badminton, tennis, basketball, handball and similar exercises in which strength or general endurance factors are not as important as in the learning of precise skills and the development of agility.

Endurance exercises do not necessarily include any of those described above. These are specific exercises which improve the function of the cardiovascular system and respiratory system. The heart, like other muscles, will become stronger with exercise. Although it cannot be exercised directly and voluntarily like the biceps or pectoral muscles, it can be given a good workout indirectly because it has the function of pumping blood with oxygen and nourishment to other muscles of the body. If one works large groups of muscles such as those of the trunk and legs, or better yet, many muscles simultaneously, a tremendous demand arises for blood to supply this need, the heart pumps energetically, greatly increasing its output, and the respirations become deeper and more rapid to supply the extra oxygen and remove carbon dioxide.

Therefore, when one does an exercise which causes him to perspire, breathe deeply and become aware of a rapidly and strongly beating heart, he may be assured that the heart and respiratory system are getting their good "work out."

Swimming Ideal

Probably the best of all such exercises is moderately hard swimming because it works almost all muscle groups simultaneously. In addition, the cold water promotes better arterial circulation and the pressure of the water against the body improves the flow of blood through the veins back to the heart. Other good endurance exercises are brisk walking, running, hard bicycle endurance work, cross-country skiing and the like, all of which apply the principle of working large groups of muscles rhythmically and long enough to make the heart work harder.

These, then, are the different types of exercises with a few examples of each. It can be seen that there is considerable overlap between the different types, yet no one exercise will produce maximal effects in all three categories. Furthermore, every individual will have different needs and abilities, so each person must decide upon his own exercise routine. For men in military service, a combination program is desirable which improves strength, endurance, agility and appearance. Older men should emphasize somewhat more the cardiovascular endurance aspects, although even for younger men, this is by far the most significant factor.

Check With Flight Surgeon

Now how are these facts incorporated into a good program of physical conditioning? To begin with, any person who is not in fairly good shape already should have a *physical examination* by his flight surgeon to be assured that such a program will be safe and to get some advice on how hard to "push it." With medical approval, and with individual reconditioning goals in mind and the specific exercises determined which will accomplish them, one may begin the program. Each exercise period should be started with a light *warm up* to prepare the body internally for vigorous action. A few light calisthenics or similar exercise for 10-12 minutes to deepen respiration and get perspiration started is sufficient. Then the more *intensive work* may be done, slowly at first and rhythmically with *stretching* and *deep breathing*. One should work hard, to the limit of his tolerance but not to the point of acute distress.

Overload Principle

The *overload principle* should be used to obtain a higher level of performance. It means, simply, harder work—one more lap, one more chin, just a few more sit-ups and the like. The muscles respond by enlarging existing fibers and making new fibers because the load imposed is greater than that usually encountered. *This is the body's adaptive mechanism which forms the basis for the entire concept of physical conditioning.*

The principle of *interval training* is also very important, being especially valuable in improving endurance and cardiovascular function. It has been used by almost all of the world's great endurance athletes such as Roger Bannister, Jim Beatty and Vladimar Kuts. In the workout, the individual never stops completely to rest but he keeps going, alternating fast and slow work for different intervals using

the slow interval as the rest interval. For example, in swimming, one might swim a fast butterfly or crawl for several laps and then do an easy breast stroke for a lap or two to recover. The principle can be applied to almost any exercise and works by keeping the demands placed upon the heart at a higher level, thereby forcing it to respond with the vital adaptive mechanism. This system has the added advantage of giving one the very most for his exercise hour because of the negligible wasted time.

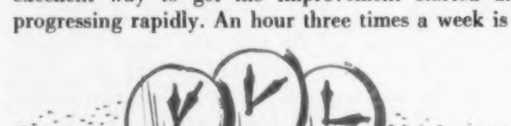
Progression and Taper off

Each workout should be characterized by *progression*. As physical condition improves, the same routine will become easy, so the workout must be made harder to keep the muscles under new stress and keep the adaptive process going. Only this way can a high level of physical condition for each individual be achieved. This is done by increasing the intensity of the exercise, or duration, or both. In the interval training system, progression is accomplished, as well, by increasing the length of the working period and decreasing the interval of the resting period.

At the end of the workout, a period of lighter work is important to allow the body to *taper off*. The body temperature returns to normal and all the waste products are removed from the muscles. Deep breathing is important to restore the oxygen debt within the muscles.

Duration and Frequency

The workouts must last *long enough* and be done *often enough* to cause the muscles, heart and blood vessels to make their physiological adaptation to stress, or no results will be seen. Obviously a fine workout once a year or once a quarter is not enough. Experts generally agree that an hour a day for six days and one complete day of rest, each week, is an excellent way to get the improvement started and progressing rapidly. An hour three times a week is a



slower way to build up, but it will work, and is much, much better than none at all. Once a person is in good condition, one hour three times a week will usually hold the level.

In addition to exercise periods, other factors (although not as important as exercise) should be included in a balanced program to build a healthful, robust physical condition. (It is recognized that

some of these additional items are not very feasible aboard ship and in some shore billets, but they are included here for completeness. To some extent, one may improvise and achieve the desired end.)

A *cold shower* or swim after vigorous exercise followed by a brisk rubdown with the towel promotes circulation and a feeling of general well-being. The transition to a cold shower should be gradual, to prevent a sudden shock to the system. Similarly, entering a swimming pool should be done by degrees, or preceded by splashing water on one's person.

Wholesome, *nourishing foods* should be emphasized, especially protein, and there should be a reduction in animal fats, fried and rich starchy food. Sunshine or ultra-violet light exposure is important because it increases the body's supply of Vitamin D. Frequent outdoor activity such as camping, boating and hiking is likewise beneficial. *Excessive use of alcohol in beverages, tobacco* (with inhaling) and *overeating* are all deleterious and will prevent attainment of the higher levels of physical fitness.

Various Sports

Concerning various *sports*, some are useful for physical conditioning and some are not. As indicated initially, each can be evaluated in terms of the three basic types of exercise—strength, agility and endurance—and a decision can be made on fitting it into the program. Certain "social" sports such as golf and bowling are valuable and important as recreation, like hobbies, but have comparatively little value in improving muscle strength or endurance.

There is, at this time, no shortcut or easy way to achieve these goals. Ten minutes a day will not significantly improve overall physical conditioning. Isometrics have only limited value in improving muscle strength and have no effect upon endurance.

Very few people have been able to just "overnight" get on such a complete program. It requires a considerable change in one's priorities and substantial self discipline. Several specific problems encountered are boredom and overcoming the great resistance to working out which is felt on some days. The boredom may be combated by working out with friends, helping each other and observing each other's progress. It is also helpful to vary the routine from time

to time, and even occasionally to substitute for the workout a hard hour of outside work or some other strenuous activity or sport.

Supervised Groups Ideal

Getting into a supervised group is ideal. Programs which involve working out alone at home or in one's quarters are often failures, although some succeed, especially when a television program is watched during the workout. Overcoming the resistance to work out may be partly accomplished by the above hints. Also helpful is the foreknowledge that *when one feels most fatigued, depressed and uninspired, he stands to gain the most from the workout which will restore his metabolism to a state of physiological and emotional balance*. This is why one feels so refreshed and invigorated after a good, hard workout and cold shower. At such a moment it is difficult for one to recall how "down and out" he may have felt an hour earlier.

Most people who have been willing to begin with a *six-month trial period* have found that they rapidly become enthusiastic proponents of physical fitness. The program grows and gets better over the months as the participant learns more about it and is encouraged by his early progress. It becomes a part of the daily habit pattern and little "workout resistance" is still encountered.

As indicated at the beginning of the discussion, the program becomes a way of life with many benefits. Very careful scientific studies show that it unquestionably improves heart function. In fact, these techniques are being extensively studied and used by the Federal Aviation Agency in their program of rehabilitating heart attack victims and returning them to a flying status. In addition, improved physical strength and appearance, more enthusiasm and interest in life, better interpersonal relationships and other gratifying rewards come from this program which, in itself is easy and enjoyable once it has been made a part of the daily routine.

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Acknowledgement

The authors of this article wish to express their appreciation to Dr. Wilhelm Raab and Dr. Edward S. Orgain for the time they took to review the manuscript and for their many useful comments and suggestions.

BRINY BAPTISM

WHEN the tension bar broke prematurely before the catapult signal was given, an E-1B moved forward on the catapult track. By the time the pilot realized he had not been catapulted it was too late for him to brake to a stop. The aircraft went off the bow at full power and settled into the water.

"We struck the water twice," the pilot recalls, "the second time filling the cockpit with water. I took a breath, unfastened my harness, unplugged my hard hat and waited for things to settle down. Taking my flashlight with me, I then exited the aircraft through my overhead hatch, which was completely submerged. Upon surfacing, I found myself on the port side of the plane with the ship rapidly approaching. I swam away from the wreckage to prevent the ship from knocking it onto me. I turned on my strobe and pulled the toggles of my life preserver. (*Pilot and copilot were wearing the Mk-3C.—Ed.*) I called for my copilot and started back to the aircraft to help him when I saw that he was all right.

"I lit a flare and was starting to pull out my shark chaser when the helicopter came for me. Rotor wash blew spray in my eyes so I lowered my helmet visor. However, with the wet green visor down, the lights from the helicopter restricted vision somewhat. The horse collar was swung to me and I slipped into it easily.

"Past training was certainly an invaluable asset in this situation. Once in the water, the Mk-3C made survival nearly routine. There was no problem in exiting the aircraft. The Mk-3C's comfort during flight and its practicality in the survival situation combine to make it the best piece of survival gear a pilot can have.

"The helicopter pilots reported that the strobe light contributed greatly to their spotting us and maintaining contact. The bright flash of the strobe did not hinder my vision.

"Everything went according to previous instructions so that in retrospect it appears as just another drill," the pilot states.

"We settled immediately off the bow and hit tail first initially," the copilot reports. "The second impact was more severe and water filled the cockpit within seconds.

"I quickly undid my lap belt and climbed out my overhead hatch. I was no sooner in the water than I saw the large dark hull of the ship bearing down on the aircraft and myself. The side of the ship struck the tail section and pushed the aircraft over on top of me.

"I was under the aircraft for what seemed like an eternity, struggling to undo my helmet chinstrap. (*The copilot reported that his chinstrap was so tight*

he had respiratory difficulties.—Ed.) All the time I was being tossed about under water I could hear the plane scraping the side of the ship. I finally surfaced and saw the stern of the ship about 100 yds away from me and the aircraft about 50 ft away on my left. I inflated my life vest, turned on my strobe light and lighted a night flare. I could see the helo moving into position. The spray from the rotors forced me to lower my visor to keep him in sight. I could see my pilot in front of me also holding a flare.

"The horse collar floated toward me. I put it around me and signaled the hoist operator I was okay. I was lifted aboard and taken to the ship without any difficulty.

"I feel the quick reaction in turning the ship's bow away from the downed aircraft gave me the extra valuable seconds I needed to exit the aircraft and probably saved my life."

There was a minimum of movement of both pilots on impact because they were strapped in tightly, the investigating flight surgeon said. Dilbert Dunker training helped immeasurably. Both men waited until the bubbles settled before egress.

Both survivors reported seeing each other's reflective hard hats. The plane guard helicopter pilot reported that the strobe lights of both survivors were clearly visible from at least four miles. The helo pilot reported difficulty when the ship's searchlights were played directly into the helo crew's eyes, just about the time the helo was approaching a hover at 40 ft. "Night vision," he said, "was definitely impaired."

"The two wet airmen," the helo pilot's report concludes, "were deposited aboard the carrier unscratched . . . approximately 10 minutes after their baptism in the briny."

HAPPY GO LUCKY

SPRING fever is a nebulous malady that strikes the majority of us around this time of year. It slows down the thinking process and produces a lethargic feeling that can cause one to get into all sorts of trouble without realizing it. Spring fever and fatigue often go hand-in-hand, and the combination can be downright dangerous . . . .

Fatigue has been positively identified as a factor in a considerable number of accidents and has been a prime suspect in many more. Unlike spring fever, fatigue causes can be identified—and cured—provided the subject will follow the prescription.

Because of the many complexities associated with fatigue, we won't attempt to discuss it in depth at this time. We do know that fatigue can be the result of muscular tension, sitting or standing still for long periods, length of duty tours, monotony, worry, fear, anxiety, lack of sleep, environmental factors, ill health, excessive use of alcohol or tobacco, ad infinitum.

The pilot who regularly gets eight hours sleep a night, drinks and smokes sparingly, is thoroughly familiar with all SOPs, has a serene home life, enjoys excellent health, has private funds to supplement his salary, subsists on a high protein diet and has a program of calisthenics will *still get tired after a long, hard day in the cockpit. BUT*, he'll be in much better shape than the poor guy with four hours sleep, one beer too many, two packs of smokes since morning, a cold sandwich for lunch prepared by a nagging wife, etc., etc., etc.

You might fool your boss, your crew and a lot of other people with your "happy-go-lucky" outward appearance. But remember, Hap, the inner attitude is *for real.* You can "go lucky" for just so long. The thump that comes when your luck runs out could very well bust your butt!

—*Flight Safety Foundation*

Loses Helmet

ON parachute deployment following a low-level ejection, an AF-9J pilot lost his helmet. When he landed, he found his helmet and oxygen mask nearby and put his helmet back on before helicopter hoist. At the time of ejection his chin strap had been loose and his visor up. (There is no mention of a nape strap.)

The accident investigation board found the fact that the pilot ejected with his helmet visor up "understandable." Because of restricted visibility under an overcast he had been flying visor up in order to see the meatball on the mirror. The ejection situation developed at such a low altitude as to preclude a planned ejection. However, on the subject of the loose chin strap, the board recommended that "all pilots be forcefully reminded of the need to fly with helmet chin straps and oxygen mask tight to guard against their loss in the event of ejection."

Automatic

I AM convinced that my survival training, taken last year, contributed materially to saving my life. I had not recently reviewed survival procedures but once in the water, all the past training, particularly that received in the Dilbert Dunker, returned automatically.

—*C-1A Pilot*

Protection

AFTER losing engine RPM due to fuel starvation a TH-13M settled into a densely wooded area as the pilot attempted to autorotate to what appeared to be a small open spot. When the rotor blades contacted the tree tops the aircraft

flipped over on its side to rest almost inverted in dense underbrush. There was no fire.

Both pilot and crewmen had their helmet visors down, the accident reports states, "possibly preventing further injury from shattered canopy or whiplash from branches of trees."

Preconceived Notion

LOSS of an A-4B was attributed to the pilot's incomplete preflight inspection before a ferry hop. The aircraft was unable to get airborne in the 5000 ft of usable runway because of 6500 lbs of water in the external tanks from a loading for a heavy weight catapult launch project.

The regular plane captain was not on hand for the preflight. The pilot mistakenly thought the replacement PC was not qualified in the A-4 and did not ask him any questions. He said later he did not notice any indication of water in the external tanks and overlooked it if it was there.

"During my preflight I rapped the external tanks but I must have had such a preconceived notion that they would be empty that the typical thud of a full tank did not register in my mind. I found no discrepancies and manned the aircraft."

Bareheaded

A PILOT, flying with his helmet strap fully loose and his oxygen mask inserted in the left Sierra fitting only, had to eject at a very low altitude immediately after takeoff. His helmet flew off on ejection and he sustained a severe cerebral concussion on ground impact. When he was found, his hard hat was 30 yards back down the line of flight.

"Because the pilot did not have his helmet chin strap cinched snugly," the investigating flight surgeon reported, "he lost his head protection on ejection. He habitually did not cinch his chin strap. The chin strap must be cinched to insure head protection and should remain so throughout every flight.

"Neither did this pilot have his oxygen mask on," the flight surgeon continued. "In this particular situation it was of no significance except that it was just one more routine function that the pilot was too hasty to perform, perhaps just one more irritation. Nevertheless, NATOPS dictates that the oxygen mask must be worn properly on all jet flights. In an acute emergency situation with almost reflex ejection, the mask is of no use or protection against facial burns or other injuries if it is dangling from one fitting or lying in the lap. Further, the advantages of preoxygenation are lost."

The pilot will be hospitalized an estimated six to eight months.

Flash Blindness Training Program

A flash blindness training program has been established in the Aviation Physiology Training Units at six Navy and Marine Corps Air Stations.

Flash blindness is considered by many in operational commands to be the most serious problem which will be faced by aviators conducting missions during nuclear conflict. The success or failure of these missions may well rest with the extent to which this problem is met. It is important, therefore, that naval aviators be indoctrinated as to the nature of the flash blindness problem and that they be given proper training in the use of flash blindness protective equipment.

Flash blindness is most serious for the attack pilot. During a low level attack, it is probable that a pilot will be exposed to the flash of one or more nuclear weapons released by other aircraft. Even at great distances, the visible energy released by such bursts is sufficient to cause retinal damage if viewed directly or "flash blindness" if not viewed directly. Such impairment of vision, even if quite brief, could cause complete failure of a mission. The purpose of this training program is to interpret the flash blindness phenomenon both psychologically and physiologically in a manner so that pilots appreciate the hazards of this event and so that appropriate action will be taken by the pilot to minimize the effects of flash blindness.

The core of the training program is the Flash Blindness Indoctrination Trainer (Device 18F22). This device consists of a high intensity flash source which simulates the light which would be encountered by a pilot at the time of a flash. With this source, it is possible to produce all of the features of flash blindness; that is, startle, intense afterimages, and visual incapacitation, without the risk of permanent damage to the ocular system.

The Navy's concern with the problem of flash blindness has led to the development of a number of protective devices. These devices range from simple techniques such as a monocular eyepatch to highly sophisticated "active" systems, which are transparent normally but which become totally opaque upon exposure to intense light. The Flash Blindness Indoctrination Trainer serves to demonstrate why and how these unique devices are used.

CHOCK TALK

The General Handling and Safety Manual (NavWeps 00-80T-96) warns us that it's good practice to have chocks nearby and at ready—we just can't predict when a mechanical failure, involving the aircraft, towing vehicle or associated equipment will take place, or when a halt must be called to the operation, when weather will kick up gusts or when a prop or jet blast might shift aircraft around.

Aboard ship, the hazards of pitching and rolling decks add to the necessity of safeguarding our birds even more. Chocks and brakes are used to help hold aircraft until the tie-downs are in place and secured. Allowance lists for shipboard operations provide us with adjustable chocks, made of aluminum and built to NavAir specifications. Dimensions for these chocks are such that they apply to all birds designed for carrier operations. Incidentally, Universal Chock, FSN RM 1730 602 6438 S030 which has been around for several years, is being replaced with Universal Chock RM 1730 974 4116 S030. Note design

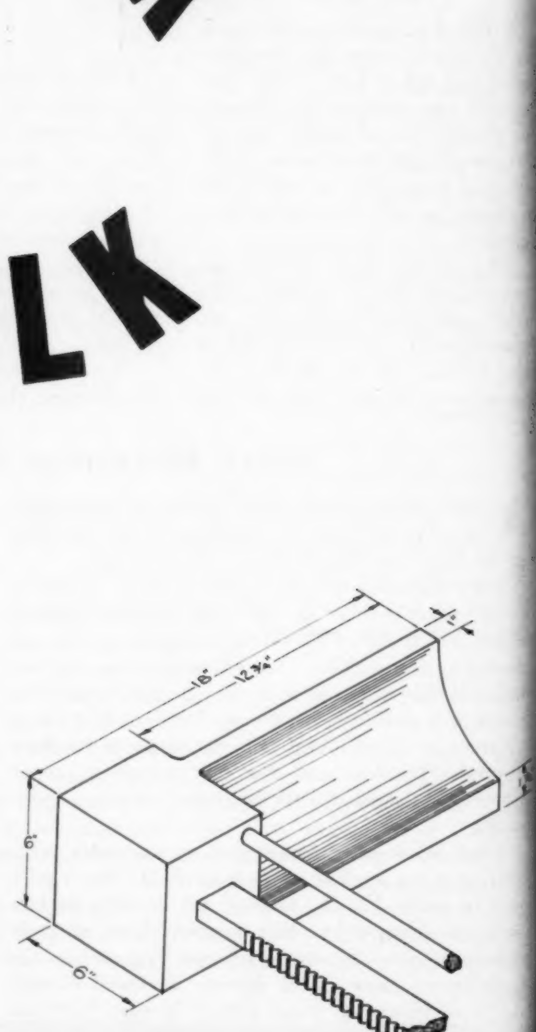
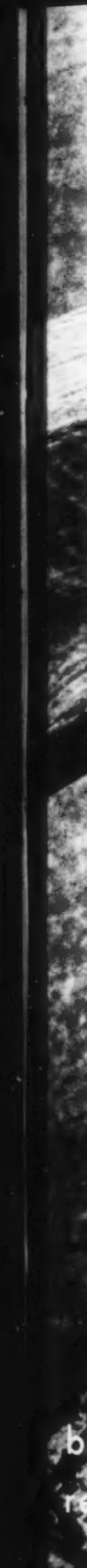


Fig. 1. Approximate dimensions of Universal Wheel Chock (carrier) FSN 1730-602-6438-S030.



Wood-hemp combination chocks make for easy handling; beveled edges and rounded corners can save a lot of skin repairs...

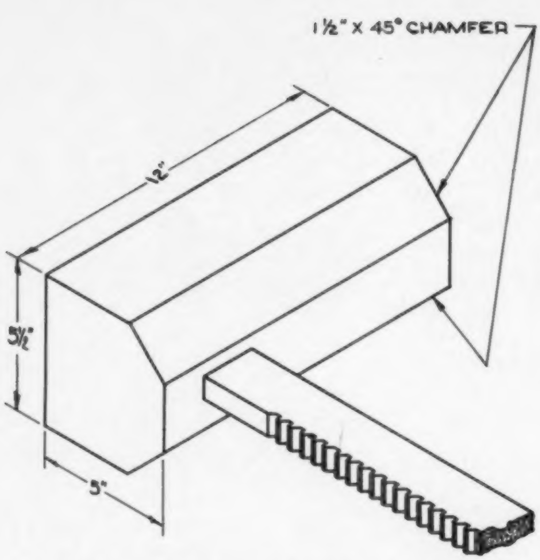


Fig. 2. Approximate dimensions of new type Universal Wheel Chock (carrier) FSN RM 1730-974-4166-S030.

and detail dimensions of each in Figures 1 and 2. No sweat here as to what type chock to use.

Ashore, the problem of what type chock to use takes on a different hue. As Confucius is supposed to have said, "Man who has choice, has problem." *Specifications for shore type chocks do not exist but local manufacture is authorized.* A look-see among operators, AMDs and O&Rs indicates the practice is to build chocks "as per sample" with little or no thought being given to the purpose of the chock and how it can best serve its purpose. Consequently, assorted and nondescript jury rigs can be seen on most aircraft parking areas.

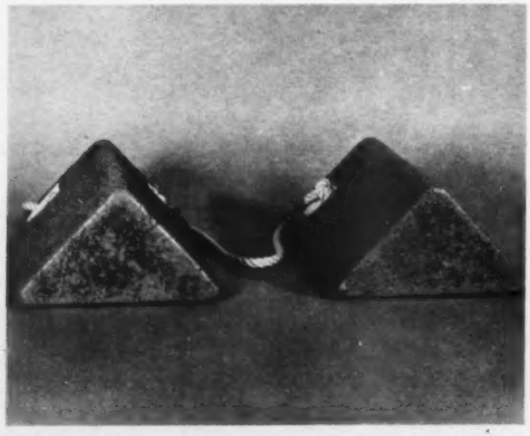


Fig. 3. Wheel Chocks made of foamed polyurethane for large shore based aircraft. Dimensions: 5½" high, 10¾" wide. They are made in 16" and 32" lengths.

Chocks range from ordinary 2X4s nailed or tied together, 4X4s with the same arrangement and some triangular shaped chocks, bound together with nylon or manila and some not. Further inspection revealed many aircraft parked without chocks and without tie-downs, apparently depending on aircraft weight and parking brakes for security, contrary to good common sense. It's a foregone conclusion that for crunch prevention, chocks are an indispensable item for parked aircraft. Some operators of helicopters are experiencing difficulties in another area. Some choppers have sponsons made of fiberglass, some have honeycombed material for decking. The handling of chocks around the gear and stowage of chocks on the decking has resulted in gouging of these components.

We're sympathetic with operators who are having this problem, but the nonuse of chocks is strictly in violation of NavSo-P2455, Safety Precautions for Shore Activities. Paragraph 0410, states "Before starting an engine, the wheels of the aircraft shall be chocked and parking brakes set." Remember, too, that even if chocked—the perfect chock hasn't been designed yet—an aircraft must be tied down for high power turnups.

NavAir 17-1-537, "Aircraft Handling and Securing Equipment," specifies the use and application of chocks as follows:

Personnel concerned with the servicing of aircraft, such as preflight and post flight procedures are considered responsible for the safe handling of aircraft chocks. The use and application of aircraft chocks is primarily a safety precaution. Procedures and operating conditions to be observed by ground personnel are contained in the following.

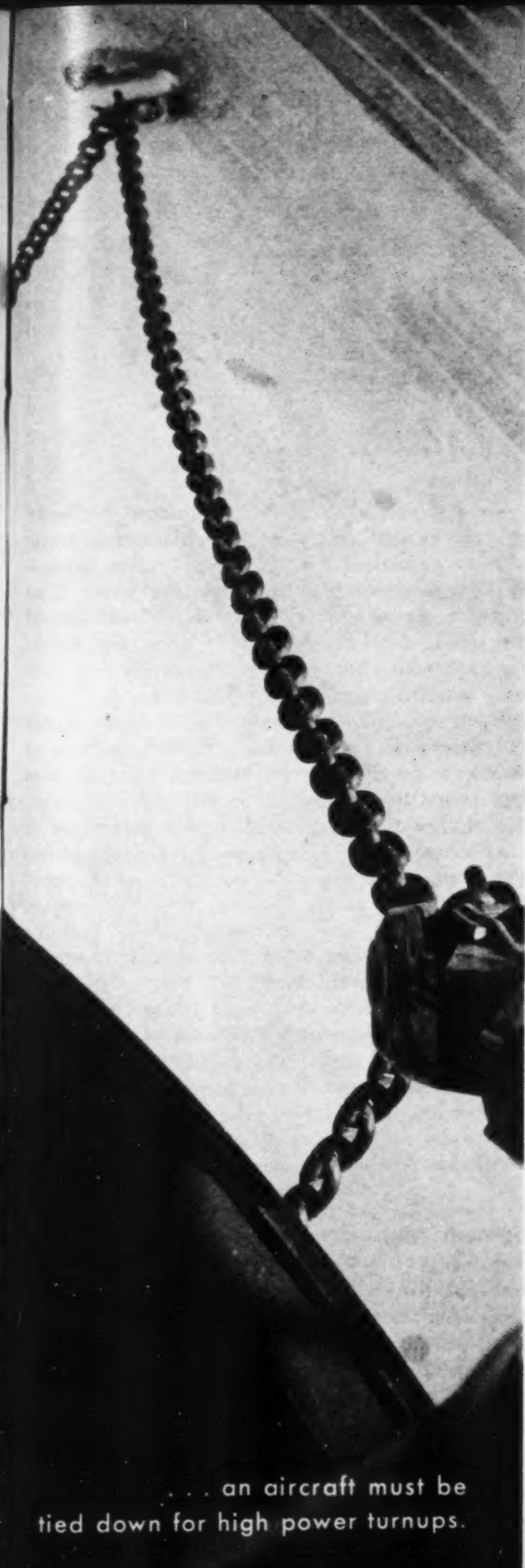
(a) When aircraft are not actually moving, chocks shall be tightly placed fore and aft of main landing gear wheels.

(b) During heavy or adverse weather, the chocks shall be lashed and pulled in against the wheel, or secured to the wheel with manila line.

(c) For all engine run-ups by qualified personnel and pilots, the aircraft shall be suitably chocked, fore and aft on main landing gear.

(d) Prior to moving or taxiing the aircraft, ground personnel shall ensure that all chocks are removed and the area is clear of any obstructions. Chocks shall be removed upon signal from the pilot or plane director.

(e) Prior to shutdown, the engine shall be kept running until the director indicates that "chocks are



. . . an aircraft must be tied down for high power turnups.

in place."

(f) Before starting aircraft, ground personnel shall ensure that all chocks are secured against the aircraft landing gear.

(g) During jacking procedures, when lifting entire aircraft, install chocks fore and aft at each landing gear wheel.

(h) When jacking individual gear, chock wheels fore and aft on landing gear not to be jacked.

(i) After lowering aircraft from jacked position, make certain chocks are properly positioned fore and aft of main landing gear wheels.

(j) When towing aircraft by towing tractor or manual parking and spotting aircraft; the chock man shall place chocks fore and aft of each main landing gear wheel immediately after aircraft is spotted.

(k) During heavy weather conditions; when aircraft is spotted, the chockman shall position chocks fore and aft of main landing gear wheels.

(l) During servicing of aircraft, make certain chocks are positioned fore and aft of main landing gear wheels.

(m) Chocks shall never be used to stop an aircraft to assist in spotting or parking position.

(n) These procedures shall be established and followed in accordance with directions and signals from the director.

Perhaps the new shore type chock shown in Figure 3 may be the answer to the dent and gouge problem. It is made of foamed polyurethane. Note the beveled corners. This feature could easily be built into the wood chocks presently in use.

When locally manufactured chocks are ordered, it might be well to consider the following factors.

For a chock to be effective, two events must occur in the following sequence:

1. The chock must be forced down hard against the deck by having part of the tire bearing down on part of it.

In the first fraction of an inch of aircraft movement, as the weight of the aircraft is transferred onto the chock, the friction between the chock and the deck rises to enormous values.

2. After this has been accomplished, the surface of the chock facing the tire should then rise at an angle to impose the necessary push force to resist forward movement of the aircraft. This is accomplished by beveling or concaving the inner surface of the chock. The initial point of contact between tire and chock is now lowered to a point closer to the bottom of the tire, permitting the tire to step onto the chock thereby inducing friction between the chock and the deck

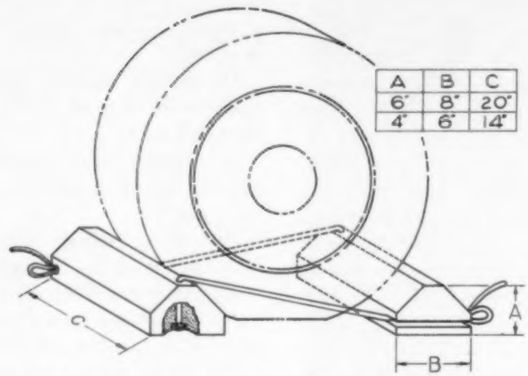


Fig. 4. USAF basic drawing for PN 42D6594 local manufacture wood chocks.

to provide maximum resistance to the rolling moment of the aircraft wheel. A chock so designed also reduces the possibility of a chock working loose as aircraft weight is shifted by winds, prop and jet blast.

In response to the questions, what formula is used to decide what type of chock is applicable to what model aircraft—is it wheel diameter, tire width, aircraft weight or a combination of these?—No particular formula is used. Extensive tests by the Air Force under all types of weather and parking conditions—slush, hard packed snows, glazed snows as well as on clear ramps determined that the basic wood chock shown in Figure 4 was adequate for all aircraft presently in the USAF inventory.

The Air Force uses the following guidelines in authorizing local manufacture of chocks:

- Wheels 33 in or smaller in diameter—4 in high, 6 in wide, 14 in long. (Helicopters, trainers and *Century* fighter series aircraft.) Length in some cases is 20 in.
- Wheels 34 in or larger in diameter—6 in high, 8 in wide, 20 in long (C-119, B-66, KC-135 and B-52).
- Dual landing gear wheels including tandem wheel aircraft 6 X 8 X 56 in.

Since there are no Navy specifications for shore type chocks and because local manufacture is necessary and authorized, it would appear prudent to benefit by experience with those designs which have proven to be satisfactory. One word of caution—if you should decide to follow the design depicted in Figure 2—this chock was found unsatisfactory with large wheeled aircraft—i.e. C-118, P-2, P-3.

If, at this point you have selected chock design and dimensions, you're probably thinking in terms of whether to use rigid frame chocks or the more flexible type bound together with a manila hemp or nylon line. Either type is permissible but preference is usually based on the model aircraft it is designed for. The flexible type is popular among transport, patrol and helicopter people because of more compact stowage aboard, and ease of handling. Training squadrons and other fixed line operators seem to prefer rigid frame chocks.

Should you decide on a rigid frame chock, keep in mind it must be made with nonsparking hardware. Wire nails, steel screws and the like are prohibited. Brass screws or wood dowling are recommended. Remember too, that a little time spent in rounding off the corners and beveling the sharp edges can save a lot of skin repairs—both your's and the aircraft.

Aircraft Handling & Securing Equipment Manual now available

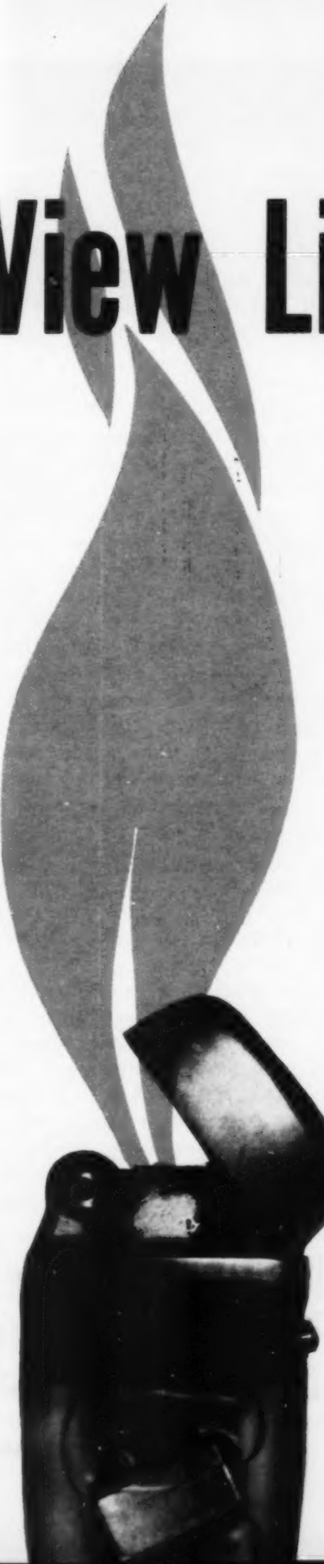
NavAir 17-1-537, "Technical Manual, Operation and Service Procedures, Aircraft Handling and Securing Equipment," dated 1 Sept. 1966 describes shipboard and land base aircraft securing procedures and equipment.

Prepared by the Engineering Support Services Department of the Naval Air Technical Services Facility by the direction of the Chief, Naval Air Systems Command, it contains an applicable document list, tie-down information, identification, capacities, descriptions and operational data of securing equipment.

In addition, it contains information considered standard procedures for towing and handling of aircraft towing equipment.

Copies may be obtained by using DD Form 1348 and ordering same in accordance with NavSup Pub 2002, Section VIII.

View Lighter Hazard



For some time there have been reports of fire hazards associated with the clear (transparent) reservoir-type cigarette lighters. This type of lighter is described as one having a sealed fluid chamber separate from the wick compartment. The fluid chamber is sealed off from the wick compartment by a valve which normally remains in the closed position under a spring load. When fluid is desired in the wick compartment, the valve is pressed open, the lighter is tilted, and fluid is drained into the compartment containing the wick. The valve is then allowed to close thereby shutting off the fluid.

Several occurrences of lighter fires in flight have been brought to the attention of the FAA indicating that with an increase in altitude, fluid from the chamber seeps into and floods the wick area or, prior to ignition, the user presses the valve allowing fluid to spurt into the wick area. This action with the pressure buildup in the fluid compartment due to the increase in altitude causes the lighter to flood. When the lighter is ignited, a fire of such magnitude occurs that the user is surprised and sometimes drops the burning lighter, causing a very serious fire hazard. This is an occurrence that has happened in flight aboard both airline and general aviation aircraft.

The seriousness of such an occurrence is obvious; and although the manufacturers of such lighters publish warnings regarding their use at altitude, the user does not always remember the warning or understand the potential hazard. Flight attendants or crewmembers observing passengers preparing to use this type of lighter in flight should caution them against its use.

—FAA AC 91-7

Impoundments of Aircraft and Engines for 'Unexplained' Incidents

By W. W. Rust, Propulsion Div.
Naval Air Systems Command

Several messages have been issued by the Naval Air Systems Command, during the past year or so, requesting impoundment of aircraft and engines involved in engine incidents wherein the probable cause is not evident. The reason—a history of unexplained incidents of loss of thrust, flameouts, slow acceleration, or other abnormalities had been reported and local troubleshooting or changing of engines, controls, or other components, and shipment thereof to O&R for priority DIR, has revealed no discrepancies which might have created the reported symptoms.

It was determined that a team of specialists composed of representatives from the airframe manufacturer, the engine manufacturer, the engine control manufacturer, the O&R, NATTS, AEL, NASC, and others should conduct a first-hand investigation of a typical "bad-actor," without anything having been disturbed on the engine or airframe, insofar as practicable. A number of teams have since been convened and have conducted investigations with varying degrees of success.

Unfortunately, many circumstances dictate urgency in the correction of these incidents, without a methodical investigation by a team of experts. There is a logical cause for every incident, whether it stems from the cockpit, the maintenance crew, or one or more pieces of equipment, and we must ensure that incipient problems, regardless of cause, are corrected on-the-double if safety is involved.

When one of these "unexplainable" incidents occurs it is important that as much information as is available be made known to the investigators to save time and point the investigation in the right direction at the outset.

The pilot must provide as much dope about the incident including the flight condition, the gage readings, the unusual noises, the vibrations, or other changes from normal that he can remember accurately. He should specify which gage readings he is not sure of, or could not observe at all, so as to eliminate possible confusion in the analysis.

Maintenance should make notes of everything unusual that would provide a clue, from the engine and

Maintenance should make notes of everything unusual. . . from the engine and accessory records, maintenance requirements cards and yellow sheet squawks.

A field service rep should be called in the case of troublesome engines.

accessory records, maintenance requirements cards and yellow sheet squawks . . . Time histories of the equipment involved are vital elements in many cases. Fixes may be available for certain potential deficiencies but they may not yet have been incorporated.

A complete inspection of all power plant equipment, adjustments, the positions of all variable geometry systems such as IGVs, bleed valves, inlet duct, exhaust nozzle. . . , should be made and any unusual condition noted. Armed with all this information, and if the probable cause is still not evident, the nearest Field Service representative of the engine manufacturer should be called to the scene. The Field Service representative may be able to pinpoint the problem from the information available. If so, corrective action can be taken on the spot; if not, a call should be placed, if practicable, to the Naval Air Systems Command engine project engineer, after first having advised the appropriate chain-of-command.

It is virtually impossible to specify in advance what troubleshooting procedures to follow, when to change engines or components, when to call for a special investigating team, or whether it would be safe to refly the airplane. Communications with knowledgeable technical personnel are vital to the ultimate correction of these unexplainable incidents.

All actions should be followed up by official correspondence or messages, but we don't want this to hamper the "cause of truth." It is suspect that many incidents have gone unreported because of thinking that the airplane may be grounded away-from-base, or hangared for a long period of time detracting from the activities' operational capability and readiness. Keep in mind that the NASC technical man will not try to make command decisions. He will make a recommendation, on the basis of the observed data, as to whether or not a safety of flight hazard exists, or what precautions if any should be taken. The ultimate decision, in a critical situation such as imminent deployment or where the airplane is urgently needed, belongs to the CO, or further up the chain-of-command.

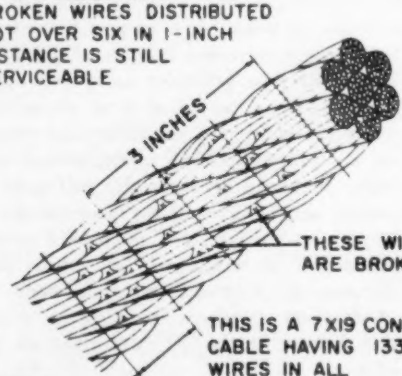
General Power Plant Bulletin No. 9 explains in a little more detail what steps should be taken at the local level before an airplane and engine are impounded, and before a special investigating team is sent to the scene. The Bulletin cancels all outstanding messages requesting impoundments.

Control Cable Inspection

Several recent F-8 throttle cable failures make suspect improper cockpit procedures—that of engaging the Automatic Power Compensator with throttle friction adjustment too tight. Such action may cause throttle cable failure, particularly if a fatigued condition exists.

Although replacement of the F-8 throttle cables has been directed by issuance of F-8 Interim Airframe Bulletin 75, Rev. A, Amendment 1, through NavAirSysCom message 101737Z Jan 1967, the reliability of the inspection of this and other control cables is also open to question. A review of standing practices appears to be in order.

Broken strands can best be detected by wiping down the cable with a rag or glove. Broken wires will be indicated where the cloth or glove is snagged. Control cables vary from 1/16 to 3/8 inch in diameter. Cables of 1/8 inch and larger are composed of 7 strands of 19 wires each. Cables 1/16 and 3/32 inch in diameter are composed of 7 strands of 7 wires each.



The criteria for the serviceability or replacement of a cable is outlined in paragraph 11-8 of NavAer 01-1A-8, Aircraft Structural Hardware. Generally any 7 x 19 cable showing more than 6 wires broken in any 1-inch length, or any 7 x 7 cable with more than 3 wires broken in any 1-inch length shall be replaced.

Where a cable passes over pulleys, drums, or through fairleads, 3 broken wires require cable replacement.

Control cables also require inspection for corrosion and wear. Exterior corrosion in itself does not require cable replacement. But when exterior corrosion is evident, the cable should be slackened and the cable untwisted for inspection of possible interior corrosion. A cable with corroded interior strands constitutes failure and should be replaced. Cables with corroded exterior should be cleaned and treated in accordance with applicable directives. In any case, the cables must be cleaned with approved PS-661 Type II solvent or degreaser, Mil-T-7003.

Any 7 x 7 cable having 3 wires or less per inch worn more than halfway through the wire diameter, or any 7 x 19 cable having 6 wires or less per inch worn more than halfway through the wire diameter, and *provided that no broken wires are present in the worn area,* shall be considered serviceable. The cable shall be considered serviceable if broken wires are present, but not in the worn area. One less worn wire per inch is allowable for each broken wire present in the same inch. If more than one area is found and all are within specified limits the cable is satisfactory, provided no two worn spots are adjacent circumferentially.

Kinked, twisted, or bird-caged cables must be replaced.

Units expecting to be on extended operations, or expecting to enter operations that will probably demand violent maneuvers, should replace cables under these permissible limitations.

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MURPHY'S LAW*

Inboard →

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Correct

SP-2H Murphy

Following replacement of the port inboard flap section and installation of a new flap control assembly, a functional check of the flaps was made. Upon operation the jack screw commenced bending as the flaps started retraction.

Analysis of this incident revealed the gear box had been installed 180 degrees out during replacement. (See photos for the incorrect and the *correct* installation.)

"This particular case certainly points out the validity of Murphy's Law," comments the C.O., "but more important, it demonstrates again that correct installation procedures are listed in the Maintenance Manual for a reason. Volume 3, para. 3-98 of the Airframes Group reads, 'To install gear boxes, reverse removal procedure, *making certain* driving gear cover plate is facing inboard.' "

—Contributed by VP-11

**If an aircraft part can be installed incorrectly, someone will install it that way!*

Letters

Ear Plugs

FPO, San Francisco—I strongly disagree with your recommendation concerning the use of ear plugs in flight (Letters to the Editor, APPROACH, September 1966). There is little danger of the plugs causing harm if used by properly indoctrinated personnel. The miracle of the plug is that it attenuates noise, i.e., static, to a greater degree than it does voice communications and hence improves reception under most conditions. Ear plugs worn in flight, once become accustomed to, contribute greatly to reducing aircrew fatigue and last but not least help save our hearing. Ask anyone who flies an ear banger like the HU-16E or S-2F.

LCDR M. J. KAISER, USCG
CGAS, SANGLEY POINT

• You are correct in your views. A letter on the same subject from the flight surgeons aboard SHANGRI-LA (CVA-38) appeared in the Letters to the Editor section, December 1966 APPROACH.

Parachute Bag

FPO, New York—For some time now, I have been wondering about perhaps an insignificant item, but nonetheless a bothersome one. The object in question is Bag Parachute, Carrying FSN RM 1670-095-0100-L800, reference *Section H Allowance List* (NavWeps 00-35QH-2) page 1, item 2.

The cost of this bag is $5, yet from a rigger's viewpoint, this parachute bag is unfinished. Why? Because all parachute riggers who are worth their salt sear or tape the freshly cut ends of nylon fabric. Unless this is done, the fabric will unravel.

In my opinion, the top stitching which is on all parachute bags is cutting corners. Take a look at the inside of a new parachute bag. Notice that the ends of the two pieces of fabric are sewn, then top stitched, but not seared or taped to prevent unraveling. Notice how easily the nylon fabric unravels at the touch.

Now try to locate a well-used nylon parachute bag (manufactured by contract) and attempt to open the slide fastener. Do you notice that there is a reluctance for the slider to open effortlessly because there are quite a few loose strands of nylon embedded in both the teeth of the chain and in the slider?

I am sure that all who utilize the parachute bag would enjoy seeing this trivial item corrected.

PR1 JAMES D. CENSALE
VQ-2

• Thank you for your letter. We are forwarding it to Headquarters, Naval Air Systems Command for referral to the cognizant desk.

Tool for Investigation

Moffett Field, Calif.—The suddenness with which an aircraft accident occurs frequently places the aviation safety officer in a position wherein he must make his way to the scene with a minimum of equipment and assistance . . . Under these circumstances, the safety officer usually finds that he has insufficient time in which to write down each important item of information or bit of data as it is discovered during the initial stages of the investigation. Unfortunately the failure of the investigating personnel to note certain data at this time may severely hamper the final determination of the cause factor or factors involved.

In order to provide a rapid data-gathering capability during the initial investigative effort, it is recommended that a miniaturized, battery-powered tape recorder be included in each ASO accident investigation kit. Such a device, easily carried on a shoulder strap or belt loop, would enable the safety officer to record pertinent data directly on tape as the preliminary investigation progressed. Necessary information (i.e., cockpit switch positions, instrument and fuel gage readings, wreckage locations, etc.) could be conveniently recorded immediately at the crash site, eliminating the need for the hastily scribbled notes which so frequently are illegible at a later time. It is felt that the usefulness of such a device would far outweigh the minor cost involved in procurement.

LCDR F. H. WOOD
ASO, COMFAIRWINGSPA[C]

• A small tape recorder as described could be useful for witness statements and interviews, but NavAvnSafeCen accident investigators do not recommend it for recording switch positions, gage readings, etc. Use a photographer to record such items and ensure that the switches are not moved from their original positions before the accident board arrives.

In view of the cost and number of reporting custodians, consideration might be given to equipping major commands (NAS, CVAs) with such an item to support their tenant activities.

APPROACH welcomes letters from its readers. All letters should be signed though names will be withheld on request.

Address: APPROACH Editor, U. S. Naval Aviation Safety Center, NAS Norfolk, Va. 23511. Views expressed are those of the writers and do not imply endorsement by the U. S. Naval Aviation Safety Center.

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Vol 12 **approach** No 10

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Pages 37, 39 & IBC: Pho
courtesy PHAN D. A. Wildi
VP-21.

Purposes and policies: Appro
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Naval Aviation Safety Center,
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